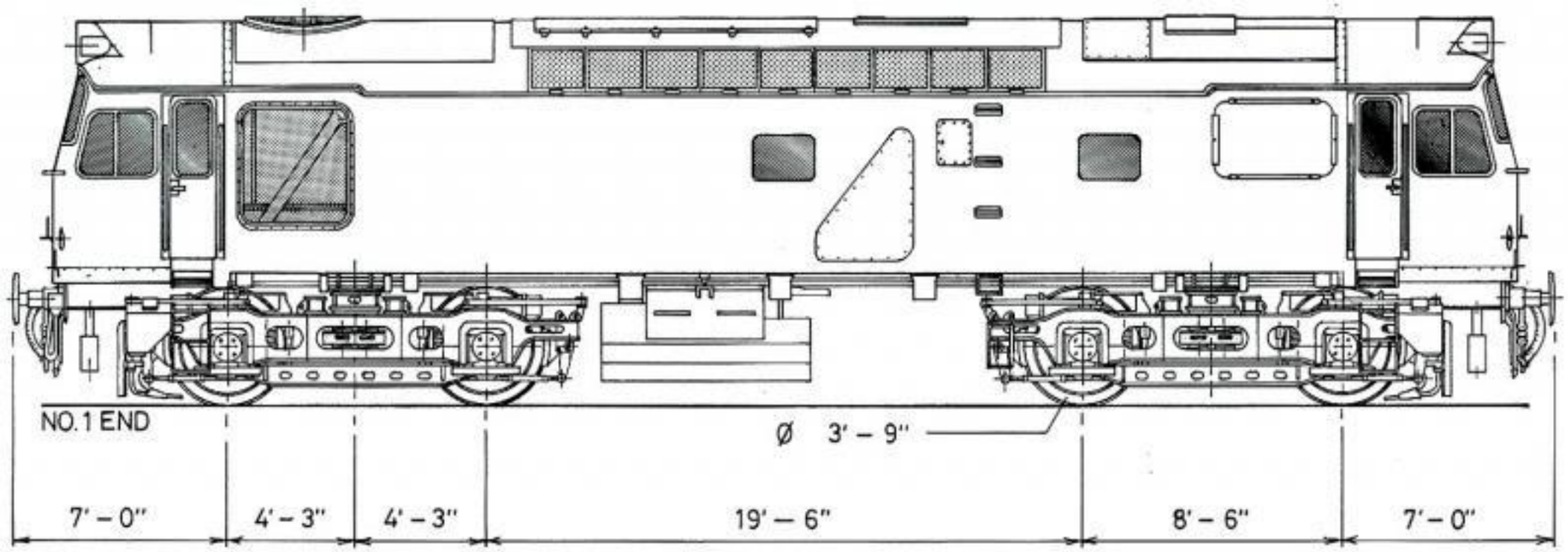
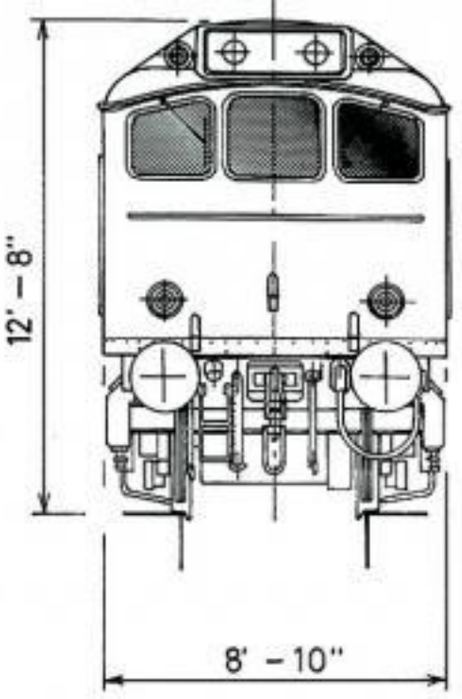
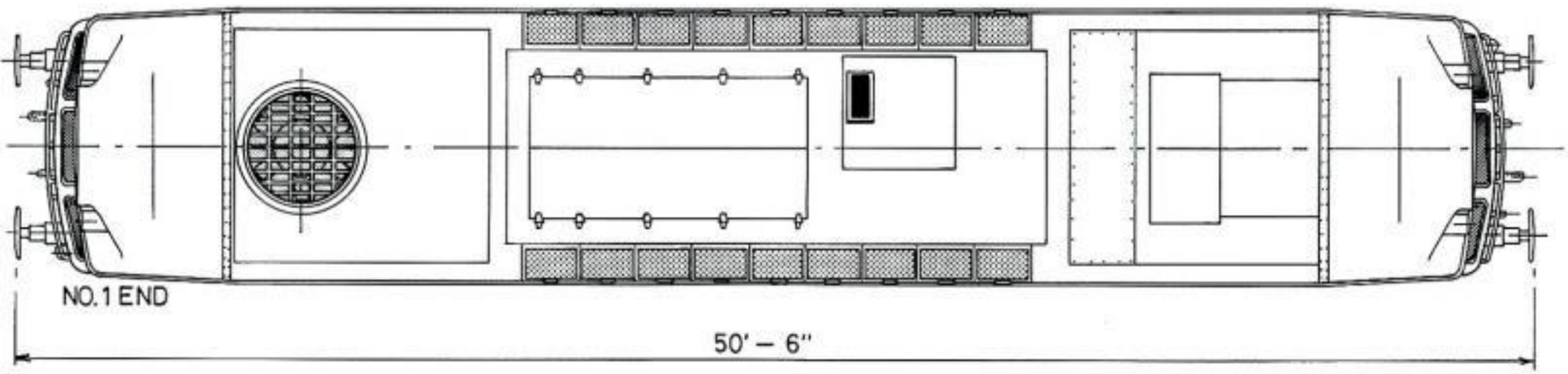
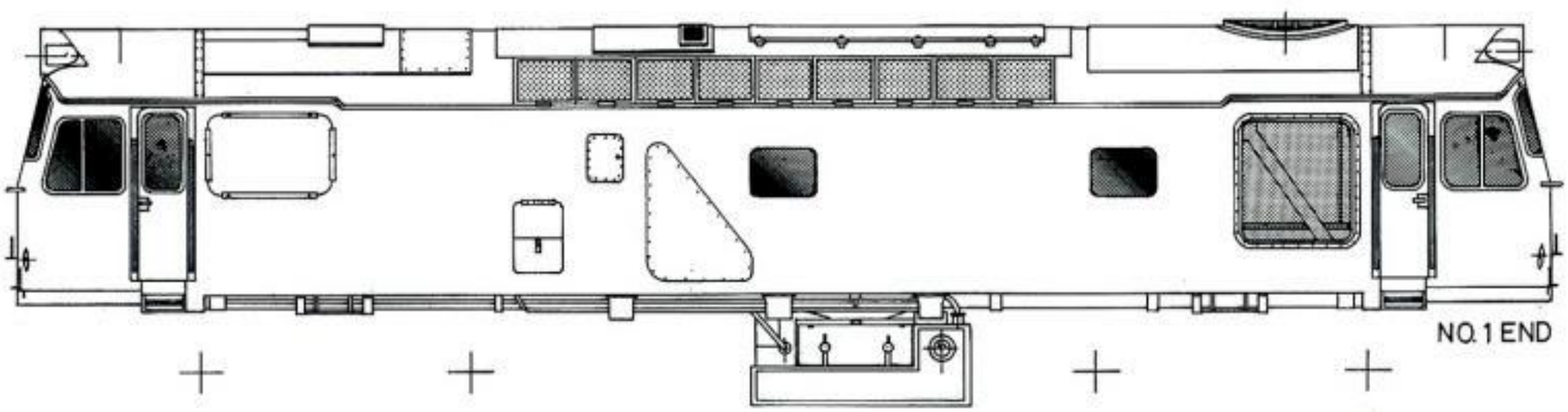

NO.1 END
Ø 3' – 9"
7' – 0"
4' – 3"
4' – 3"
19' – 6"
8' – 6"
7' – 0"


12' – 8"
8' – 10"


NO.1 END
50' – 6"


NO.1 END

D5176-D5299, D7500-D7677

Manufacturers	
Locomotive Builder	British Railways Beyer Peacock Ltd., Gorton
Power Equipment	A.E.I. Ltd., (Traction Division) Sulzer Bros. (London) Ltd.
Locomotive Dimensions	
Wheel arrangement	B–B
Length over buffers	50'–6"
Width over body	8'–11 5/8"
Height	12'–8"
Total Wheelbase	36'–6"
Bogie Wheelbase	8'–6"
Bogie pivot centres	28'–0"
Weights in working order	
D5176–D5178, D5183–D5232, and D7568–D7597	73 ton 15 cwt.
D5179–D5182	71 ton 9 cwt.
D5233–D5237	73 ton 1 cwt.
D5238–D5299, D7500–D7567, and D7598–D7677	70 ton 14 cwt.
Max. axle loads	
D5176–D5178, D5183–D5232, and D7568–D7597	18 ton 17 cwt.
D5179–D5182	18 ton 5 cwt.
D5233–D5237	18 ton 12 cwt.
D5238–D5299, D7500–D7567, and D7598–D7677	18 ton 1 cwt.
Capacities	
Fuel—engine and boiler	510 gallons
Lubricating oil	100 gallons
Coolant	186 gallons
Boiler water	
D5176–D5178, D5183–D5237, and D7568–D7597	580 gallons
Diesel Engine	
Type	Sulzer 6LDA28–B
Continuous Rating	1,250 b.h.p. at 750 r.p.m.
Bore	280 mm. (11·02 in.)
Stroke	360 mm. (14·16 in.)
Main Generator	
Type	A.E.I. RTB 15656
Continuous Rating	780 volts at 1050 amps
1 hour Rating	545 volts at 1500 amps
Maximum current	2640 amps

Recognition and Equipment information

CLASS 25

Directly following the Class 24 locos came the Class 25s, which were almost identical except for detail and power unit alterations. This fleet, which eventually ran to 323 examples, was ordered subsequent to the pilot scheme, and commenced delivery in April 1961.

The first batch of BR standard Type 2s, as they became known, was constructed by BR Darlington Works, with repeat orders going to Darlington, Derby and the private sector. One of the main differences between this class and the Class 24s was the installation of the higher powered Sulzer 6LDA28B engine giving an output of 1,250hp. The first 25 locos retained the same electrical equipment as the Class 24s, but subsequent examples were given AEI equipment, which gave an increased speed of 90mph.

During the course of production a number of modifications were incorporated into these locos in terms of front end layout and side ventilation grilles, this is detailed below. The first standard Type 2 No. D5151 (25001) was allocated to the North Eastern Region, but after some 32 locos the area of allocation was changed to the London Midland Region which received all locos up to No. D7597. Nos. D7598-D7610/D7624-D7649 went to the Eastern, while the Scottish Region received Nos. D761 1-D7623. Locos above No. D7649 were all allocated to the LMR. Of course a considerable amount of re-allocation took place over the years, including many locos allocated to the WR to replace diesel-hydraulic types.

When the order for locos Nos. D7624-D7677 was placed, Beyer Peacock & Co of Manchester were awarded the contract. Unfortunately, due to company problems, construction of the final 17 locos was handed back to BR at Derby, from where the last loco entered service on May 17, 1 967.

Under the TOPS 5-figure classification system the Class 25 fleet was divided into four sub-classes 25/0-25/3, this was mainly to identify different electrical equipment. In 1986 a further sub-class, 25/9 was formed, when a fleet of 12 were selected for dedicated 'Railfreight' operation by the Chemical and Industrial Mineral subsector.

When delivered all locos except the final 17 were painted in various configurations of green, the last batch emerging in BR rail blue. As time progressed all locos were repainted into standard blue with full yellow warning ends.
With the decline of freight traffic and the rationalisation of the BR traction fleet, the Class 25s were doomed with withdrawals commencing in the late 1970s, the final loco being withdrawn in 1987. Thankfully several members of the fleet have been preserved.

Main body differences

Two different body designs were used in the Class 25 build:
D5151-D5176 (25001-25026) Front gangway, bodyside grilles, no horns on front.
D5177-D5232 (25027-25082) Front gangway, with bodyside grilles.
D5233-D7567 (25083-25217) No gangway, cant height grilles.
D7568-D7597 (25218-25247) Front gangway, with bodyside grilles.
D7598-D7677 (25248-25327) No gangway, cant height grilles.

Displaying an almost identical body to the Class 24, No. D5155 is seen when brand new in standard BR green livery. The loco is seen from the No. 2 end. This was a

Darlington Works product, which emerged in June 1961. Compared with the Class 24 the front end has been cleaned up with a roof mounted four character route indicator, but without roof mounted horns. *CJM Collection.*

In the same body style as the above illustration, but this time with horns adjacent to the former route indicator box, No. 25223 is seen shunting clay hood wagons at Lostwithiel, Cornwall on June 26, 1978. By the time this picture was taken the former nose end doors had been sealed up and the original four digit display route indicator box had been painted black with two white cut outs as frontal indication. *CJM.*

No. D7633, preserved on the Severn Valley Railway, displays the revised and cleaned up body style applied to the Class 25 fleet. This came about after the abolition of the front end communicating doors and a wish to tidy up the body side grille arrangement. This view shows the No. 1 or cooler group end nearest the camera and shows the two-tone green livery style with small yellow warning end. *CJM.*

After 1967 the Class 25s started to emerge from works in rail blue, as shown here on No. 25322 which has also gained a wrap round yellow end and grey roof, together with the painted-on name *Tamworth Castle*. This loco is viewed from its No. 1 end and shows the revised underframe arrangement for locos without steam heat, having a large space between the bogies where the boiler water tank was fitted. *CJM.*

British Rail Class 24

From Wikipedia, the free encyclopedia

Main page
Contents
Featured content
Current events
Random article
Donate to Wikipedia
Wikipedia store

Interaction
Help
About Wikipedia
Community portal
Recent changes
Contact page

Tools
What links here
Related changes
Upload file
Special pages
Permanent link
Page information
Wikidata item
Cite this page

Print/export
Create a book
Download as PDF
Printable version

Languages
Simple English

Edit links

The British Rail **Class 24** diesel locomotives, also known as the **Sulzer Type 2**, were built from 1958 to 1961. One hundred and fifty-one of these locomotives were built at Derby, Crewe and Darlington, the first twenty of them as part of the British Rail 1955 Modernisation Plan. This class was used as the basis for the development of the Class 25 locomotives.

The final survivor, no. 24081, was withdrawn from Crewe depot in 1980.

Contents

1 Technical details
1.1 Engine
1.2 Transmission
1.3 Train heating
1.4 Other systems
2 External condition
2.1 Liveries
2.2 Alterations
3 Operation
3.1 Departmental use
3.2 Withdrawal
4 Preservation
5 Accidents
6 References and sources
6.1 References
6.2 Sources
7 Further reading
8 External links

Technical details [edit]

Engine [edit]

The main power for the Class 24 was the Sulzer 6LDA28 diesel engine - denoting 6 cylinders; Locomotive use; Direct fuel injection; (turbo-charged); 28 cm (11 in) bore cylinders. This was effectively an off-the-shelf purchase with small changes to bearings, injectors and some other minor items. The same engine was used in the CIE 101 Class locomotives in Ireland.

Transmission [edit]

The diesel engine powered another off-the-shelf product, the British Thomson-Houston (BTH) RTB15656 main generator which, in the Class 24, was rated at 735 kW (986 hp), 750/525 V and 980/1400 A at 750 rpm. Traction motors, one per axle, were also by BTH being the type 137BY rated at 222 hp (166 kW), 525 V, 350 A at 560 rpm connected to the axle via a 16:81 gear stepdown ratio, each force ventilated by an AEI 12.2 hp (9.1 kW) electric motor.

Train heating [edit]

The original pilot scheme locos (D5000–D5019) were fitted with a Stone Vapour type OK4646A steam heating boiler with a 600 imp gal (2,700 l; 720 US gal) water tank. The following ten locos had the similar 1,750 pounds (790 kg) per hour type OK4616B and a reduced water capacity of 450 imp gal (2,000 l; 540 US gal), and this was perpetuated in the remaining production run which used the Stone Vapour 1,000 pounds (450 kg) per hour type L4610 boiler. These variations meant that the initial batch of 20 locomotives tipped the scales at 79 long tons 16 hundredweight (81.1 t; 89.4 short tons); the following 10 locomotives slightly lower at 78 long tons 16 hundredweight (80.1 t; 88.3 short tons); the remainder of the Class 24/0 at 77 long tons (78 t; 86 short tons); and

British Railways Type 2
British Rail Class 24

Class 24, no. 24065 at Motherwell depot, May 1976

Type and origin	
Power type	Diesel-electric
Builder	British Railways' Derby Works, Darlington Works and Crewe Works
Build date	1958–1961
Total produced	151
Specifications	
Configuration	Bo-Bo
UIC classification	Bo-Bo
Gauge	4 ft 8½ in (1,435 mm) standard gauge
Wheel diameter	3 ft 9 in (1.143 m)
Minimum curve	4.5 chains (91 m)
Wheelbase	36 ft 6 in (11.13 m)
Length	50 ft 6 in (15.39 m)
Width	8 ft 10 in (2.69 m)
Height	12 ft 8 in (3.86 m)
Locomotive weight	*Class 24/0:* 79 long tons (80.3 t; 88.5 short tons) *Class 24/1:* 73 long tons (74.2 t; 81.8 short tons)
Fuel capacity	*Class 24/0:* 546 imp gal (2,480 l; 656 US gal) *Class 24/1:* 500 imp gal (2,300 l; 600 US gal)
Prime mover	Sulzer 6LDA28
Generator	BTH RTB15656 DC
Traction motors	BTH 137BY, DC, 4 off
Transmission	Diesel electric
Multiple working	★ Blue Star
Performance figures	
Maximum speed	75 mph (121 km/h)
Power output	*Engine:* 1,160 hp (865 kW) *At rail:* 843 hp (629 kW)
Tractive effort	*Maximum:* 42,000 lbf (186.8 kN) *Continuous:* 21,300 lbf (94.7 kN)
Train heating	Steam
Locomotive brakeforce	38 long tons-force (380 kN)
Train brakes	Vacuum
Career	

the Class 24/1 at 73 long tons (74 t; 82 short tons) exactly. During subsequent years the boilers were removed from the majority of Class 24/1 locomotives, reducing the overall weight by 2 long tons (2.03 t; 2.24 short tons). Ten locomotives (D5102–5111) had no train heating, the space being occupied by the air compressors needed for operation of the Consett iron ore trains.[1]

Operator(s)	British Railways
Number(s)	D5000–D5150; later 24001–24047, 24051–24141
Axle load class	*Class 24/0:* RA 7 (6 from 1969) *Class 24/1:* RA 6 (5 from 1959)
Retired	1967–1980
Preserved	Four (list)

Other systems [edit]

Several of the systems within the Class 24s were standard. The braking system was the standard BR system, adopted as part of the Modernisation Plan, of locomotive air and train vacuum brake, both applied by a single handle via a proportional valve. Similarly the connection for multiple working was the standard electro-pneumatic system designated "Blue Star" with each loco bearing a small blue coloured 5-pointed star above each buffer to denote this. Also common was the provision of a door to allow staff to pass between locomotives, or between a locomotive and adjacent coach. In practice these were rarely used and were sealed shut at overhaul during the 1970s to reduce draughts in the cab.

With production reaching 151 there were some differences between batches of locos too. Ten of the initial twenty had "Athermos" pressure-lubricated plain bearing axleboxes rather than the more usual roller-bearing axleboxes. Although these remained for the life of the locos they were the only ones so fitted. Much more noticeable were D5114–D5132 which were fitted with tablet catchers on the side of the drivers cab for use on the Far North Line from Inverness. Also very visible were the roof-mounted headcode boxes fitted from D5114 giving an outward appearance very similar to the later Class 25 but without horn grilles.

External condition [edit]

Liveries [edit]

The pilot scheme locomotives were delivered in overall green livery with a grey roof and black below the body. D5000 was delivered with a narrow white stripe at waist level while the remainder sported a broad white stripe at solebar level. At first green liveried locos had plain green ends, but this was changed later to small yellow warning panels, and then to full yellow end, some locos receiving these while still in green livery. At least one loco, D5005, is recorded in 1966 as having two-tone green livery applied along with the small yellow warning panel in a similar manner to Class 47s and some Class 25s.[2]

Alterations [edit]

As with many large classes of locomotive, there were some variations during the Class 24s' lifetime, some affecting all of the class (nominally), and others just individual locos. One such locomotive was 24133, one of the last survivors of the class and easily recognised as it had different headcode boxes on each end, the standard one for the class at one end and that at the other end matching those used on the Class 27.[3] This was not unique, as 24145 had a headcode box similar to those fitted to later batches of Class 25s.[4] In each case, this is likely to be due to collision damage repairs. Some Inverness-based locomotives had 'car lights' fitted to each nose. These were after-market car headlamps mounted in the plated-over nose doors, to provide extra visibility to users of level crossings on sharply curved branch lines. D5114-132 had pairs mounted in each nose. These were removed between 1975/6, with small plates welded over the apertures. 12 Class 26s had similar modifications, some having pairs and others having a single lamp. Examples of Class 37s, Class 47s and a solitary Class 86 had single railway spotlights installed at each end but the Class 24s and Class 26s were the only ones fitted with proper car headlamps.

Operation [edit]

Initial deliveries were for operation in the Crewe and Derby areas, but fifteen of the initial twenty were diverted for use on the Southern Region to cover for delays in the Kent Coast Electrification scheme.[5] Here the heavy weight was not acceptable and the locos in question had to have their boilers removed before they were accepted. Later some locos had their boilers re-fitted and these examples could be found, often in tandem with a Class 33 to provide steam heating to the coaches, the 33s only having electric train heat (ETH).

As deliveries continued allocations were made to both the London Midland Region and Eastern Region, and with the class becoming familiar to crews and staff around London they were used on freight trains over the Metropolitan Widened Lines, locos so used being fitted with London Transport tripcocks – although these were removed after closure of this route in 1971. Locos allocated to East Anglia for use on freight soon became redundant due to the run down of freight in that region, and these were in turn moved to Wales and Lancashire.

Class 24s took over the "Condor" fast freight service between London (Hendon) and Glasgow (Gushetfaulds) in 1961, the train having previously been hauled by the metro-Vic Co-Bo locos for which it is best remembered. Thus the class was also used when a second "Condor" fast overnight freight service was introduced, running from Aston to Glasgow. These were the usual motive power from its introduction on 17 January 1963 when D5082 hauled the Down train and D5083 the up train, until replaced by the first Freightliner service in 1965.[6]

The batch D5096–D5113 were all allocated to Gateshead depot in 1966 to replace 9F steam locos on the Tyne Dock to Consett iron ore trains. These workings used a special design of bogie hopper wagon, and these locos had an additional compressor and associated pipework. These workings, typically with loads of around 1,000 tons, were double-headed and continued until taken over by Class 37s in the 1970s, when these locos were reallocated to Scottish depots. Incidentally D5096 was, when delivered in January 1960, the first main line diesel locomotive to be built at Darlington Works.[7]

The next batch of locos, D5114–D5132, were allocated to Inverness, and became synonymous with rail operations in the Scottish

Highlands, as did a similar batch of Class 26 locos, the two being considered interchangeable in operation. Single Class 24s operated from Inverness on passenger and freight trains of up to 290 tons, and double-headed on trains up to 580 tons including the Royal Highlander which was regularly made up of 16 coaches. Class 24s and Class 26s were used turn and turn about until all Class 24s allocated to Inverness were replaced by Class 26s in 1975.[8]

The final batch of Class 24s were allocated to the London Midland Region for use on the "Western Lines" which covered North Wales and Mid Wales. In the latter area, particularly on the ex-Cambrian Railways lines, Class 24s and the similar Class 25s were the only diesel types to be found, and crews from Aberystwyth shed were only trained on these types.[9]

Departmental use [edit]

In November 1975, 24061 was transferred to BRs research department based at Derby Works, and was allocated the number RDB968007.[7] This loco was subsequently renumbered as 97201 and was finally withdrawn on 4 December 1987,[*citation needed*] the last Class 24 to be operational on BR. After withdrawal in 1976 two Class 24s were converted into train pre-heating units and were allocated to the Western Region: 24054 was withdrawn in August[7] and became TDB968008, being allocated to Newton Abbot until withdrawn in October 1982;[7] 24142 became TDB968009 and was allocated to Landore.[10][11][12]

Withdrawal [edit]

The very first Class 24 to be withdrawn was in November 1967 when a fire broke out on D5051 while it was working a train of empty coal wagons in Scotland. The damage was too severe for it to be repaired, and it was cut up at Inverurie in August 1968.[13][14] It had lasted exactly 8 years. The second Class 24 to be withdrawn was also as the result of an accident in Scotland, this time at Castlecary. In this case D5122, running light engine, hit a stationary DMU at about 40 mph (64 km/h), the impact and subsequent fire bending the main frames and completely destroying the No.2 end. The accident happened on 9 September 1968 but despite being withdrawn the same month, the locomotive was not finally cut up until March 1971.[14][15] A total of 14 Class 24s were withdrawn and scrapped without receiving their TOPS number.[14]

Some Class 24s were withdrawn in 1973 with the closure of the Waverley route, which linked Carlisle and Edinburgh, but most of these were put into storage and subsequently re-entered traffic to fill gaps left by the movement of Class 25s to cover the withdrawal of Class 22s on the Western Region. Thus Class 24 withdrawals only started in earnest with completion of the Glasgow electrification in 1974, and re-allocation of Class 26 and Class 27 locos saw the Class 24s concentrated around various Lancashire depots and at Carlisle. On 27 November 1976 there were just ten Class 24s still in operational service, all allocated to Crewe Diesel Depot (depot code CD).[16] However, with the reinstatement of 24082 and 24073 this number climbed to 12 by February 1977.[17]

In January 1978 two farewell railtours were run – 24082 and 24087 hauled the Merseyside Express from London St Pancras to Liverpool and return on the 14th,[18] and 24087 and 24133 hauled the Cambrian Coast Express from Birmingham to Aberystwyth and Barmouth on the 28th. On the latter trip, 24087 failed on the outward journey, was dumped at Machynlleth on the return journey and never worked again.[19]

On 21 January, 24133 had also taken part in the "Farewell to the 44s" tour, providing steam heating for the coaches while 44008 Penyghent provided the motive power, on the Crewe to Chester leg of a circular tour from London.[20]

For the summer of 1978, 6 class 24s remained in service – 24023, 035, 047, 063, 081 and 082.[17] In May, a North Wales DMU passenger diagram was converted to loco haulage on Mondays to Fridays, comprising the 09.42 Llandudno - Manchester, 13.30 return, 16.42 Llandudno - Crewe, 20.30 Crewe - Bangor and 22.45 Bangor-Llandudno Junction. At least 5 different class 24s were recorded on this diagram during the summer.[21] Additionally, on Saturday 10 June, 24082 worked a Llandudno Junction – Euston relief train all the way to London due to a lack of a replacement loco at Crewe.[22]

By January 1979, only 3 locos remained in use – 24063, 081 and 082. 24082 was withdrawn on 1 March and 24063 on 9 April, leaving 24081 the last in service.[17] The final recorded passenger duty of a Class 24 was on 2 August 1979 when 24081 rescued 40129 at Colwyn Bay on the 18.05 Holyhead – Euston, hauling the train as far as Crewe.[23]

Cutting up of some Class 24s was carried out at Swindon Works on the BR Western Region, an area which had never received an allocation of Class 24s. The first locos were 24042, 24045, 24048 and 24050 which were moved from Derby Works in December 1975,[8] and the last of the 67 Class 24s cut up at Swindon was 24084 in early December 1978.[14][21][24]

The very last Class 24 to be withdrawn from operational service was 24081.[7][25] This loco, allocated to Crewe Diesel Depot (CD) had been considered something of a celebrity lasting over a year after the previous withdrawal of 24063 on 9 April 1979.[25] 24081 was finally withdrawn in October 1980 having worked its last revenue earning train, the 05.43 Grange - Shotwick freight on 7 January 1980, and then making guest appearances at Nuneaton, Crewe Works Open Day, and Southport.[25]

Preservation [edit]

Four locomotives have been preserved.

Numbers (current in bold)		Name	Livery	Location	Notes
D5032	24032	Helen Turner	BR Green	North Yorkshire Moors Railway	Undergoing overhaul
D5054	24054	PHIL SOUTHERN	BR Green	East Lancashire Railway	Undergoing overhaul

D5061	24061	Experiment	BR Green	North Yorkshire Moors Railway	Stored awaiting overhaul
D5081	**24081**		BR Blue	Gloucestershire Warwickshire Railway	Final locomotive withdrawn from traffic in 1980.

Accidents [edit]

- D 5146 was hauling a freight train that was derailed near Weedon, Northamptonshire on 1 April 1963. The accident was due to a defective wagon. An express passenger train collided with the derailed wagons.[26]
- D5002 was involved in the 1967 Stechford rail crash.[27]
- D5122 was involved in a serious accident at Castlecary, Dunbartonshire in 1968.[27]
- 5028 was involved in the Chester General rail crash in 1972.[27]

References and sources [edit]

References [edit]

1. ^ Strickland, D. C. (1983). *Locomotive Directory, every single one there has ever been*. Camberley, Surrey: Diesel and Electric Group. pp. 78–82. ISBN 0-906375-10-X.
2. ^ Kennedy, Rex (1979). *Diesels and Electrics on Shed Volume 1 - London Midland Region*. Oxford: Oxford Publishing Co. p. late 62. ISBN 0-86093-035-1.
3. ^ Goddard, Larry (November 1980). "Unique 24". *Railway Modeller* (Beer: Peco Publications & Publicity Ltd) **31** (360): p401.
4. ^ Furness, Ian. "24145 Swindon Works 070576 JP White". *wnxx. End of the Line: Withdrawn & Stored Locomotives UK*. Retrieved 2009-01-08.
5. ^ Vaughan, John (1980). *Diesels on the Southern*. Shepperton: Ian Allan. ISBN 0-7110-0989-9.
6. ^ Silsbury, Roger; Taylor, Bernard (December 1987). "Points of View: That Condor Moment". *Railway Modeller* (Beer, Seaton, Devon: Peco Publications and Publicity Ltd) **38** (446): p539.
7. ^ [a b c d e] Turner, Graham. "Rail Blue timeline". Retrieved 2008-04-10.
8. ^ [a b] Hills, David. "DerbySulzers - 1975". Retrieved 2008-03-12.
9. ^ Perkins, Chris; Oakley, Michael (1982). *BR Class 24/25 Diesels*. Truro: Bradford Barton. ISBN 0-85153-432-5.
10. ^ Marsden, Colin J. (1981). *Motive power recognition:1 Locomotives*. Shepperton: Ian Allan Ltd. ISBN 0-7110-1109-5.
11. ^ *British Rail Locoshed Book 1981*. Shepperton: Ian Allan Ltd. ISBN 0-7110-1112-5.
12. ^ Hills, David. "DerbySulzers - 1976". Retrieved 2008-03-12.
13. ^ Hills, David. "DerbySulzers - 1967". Retrieved 2008-03-12.
14. ^ [a b c d] Taylor, Ken. *A Decade After*. Walsall: Midland Railfans.
15. ^ Hills, David. "DerbySulzers - 1968". Retrieved 2008-03-12.
16. ^ *British Rail Locoshed Book 1977*. Shepperton: Ian Allan Ltd. ISBN 0-7110-0752-7.
17. ^ [a b c] Harris, Roger (1985). *The Allocation History of BR Diesels and Electrics*. Bromsgrove: Roger Harris. p. 55.
18. ^ Thornton, Gary. "Six Bells Junction". Retrieved 2010-10-28.
19. ^ Thornton, Gary. "Six Bells Junction". Retrieved 2010-10-28.
20. ^ Thornton, Gary. "Six Bells Junction". Retrieved 2010-10-28.
21. ^ [a b] Hills, David. "DerbySulzers - 1978". Retrieved 2010-10-28.
22. ^ "1980s Timewarp". Retrieved 2010-10-28.
23. ^ Hills, David. "DerbySulzers - 1979". Retrieved 2010-10-28.
24. ^ Taylor, Ken. *A Decade After (Appendix 1)*. Walsall: Midland Railfans..
25. ^ [a b c] Hills, David. "DerbySulzers - 24081". Retrieved 2008-04-10.
26. ^ Hall, Stanley (1990). *The Railway Detectives*. London: Ian Allan. pp. 123–24. ISBN 0 7110 1929 0.
27. ^ [a b c] Hills, David. "DerbySulzers - Class 24 & Class 25 accidents". Retrieved 2008-03-19.

Sources [edit]

- Stevens-Stratten, S.W.; Carter, R.S. (1978). *British Rail Main-Line Diesels*. Shepperton: Ian Allan Ltd. ISBN 0-7110-0617-2.
- Williams, Alan; Percival, David (1977). *British Railways Locomotives and Multiple Units including Preserved Locomotives 1977*. Shepperton: Ian Allan Ltd. ISBN 0-7110-0751-9.
- *ABC of British Railways Locomotives, summer 1966 Edition*. Ian Allan Ltd. 1966.

Further reading [edit]

- McManus, Michael. *Ultimate Allocations, British Railways Locomotives 1948 - 1968*. Wirral. Michael McManus.

External links [edit]

- derbysulzers.com
- Report on the crash at Castlecary on 9 September 1968

V · T · E ·	**British railway locomotives and miscellany, 1948 to present**
Diesel shunters	01 · 01/5 · 02 · 03 · 04 · 05 · 06 · 07 · 08 · 09 · 10 · 11 · 12 · 13 ·
Diesel shunters (pre-TOPS)	11001 · 11104 · 15107 · 13000 · D1/1 · D1/2 · D1/3 · D1/4 · D2/1 · D2/2 · D2/3 · D2/4 · D2/5 · D2/6 · D2/7 · D2/8 · D2/9 · D2/10 · D2/11 · D2/12 · D3/1 · D3/2 · D3/3 · D3/4 · D3/5 · D3/6 · D3/7 · D3/8 · D3/9 · D3/10 · D3/11 · D3/12 · D3/13 · D3/14 ·

Main-line diesels:	14 · 15 · 16 · 17 · 18 · 20 · 21 (I) · 21 (II) · 22 (I) · 23 · **24** · 25 · 26 · 27 · 28 · 29 · 30 · 31 · 33 · 35 · 37 · 38 · 40 · 41 (I) · 41 (II) · 41 (III) · 42 · 43 (I) · 43 (II) · 44 · 45 · 46 · 47 · 48 (I) · 48 (II) · 50 · 51 · 52 · 53 · 55 · 56 · 57 · 58 · 59 · 60 · 61 · 62 · 65 · 66 · 67 · 68 · 70 (II) ·
Main-line diesels (pre-TOPS)	10000–10001 · 10100 · 10201–10203 · 10800 · D8/1 · D8/2 · D10/1 · D10/2 · D10/3 · D11/1 · D11/2 · **D11/3** · D11/4 · D11/5 · D12/1 · D12/2 · D12/3 · D13/1 · D14/1 · D14/2 · D15/1 · D15/2 · D16/1 · D16/2 · D17/1 · D17/2 · D20/1 · D20/2 · D22/1 · D22/2 · D23/1 · D25/1 · D27/1 · D33/1 ·
Electrics	22 (II) · 70 (I) · 71 · 72 · 73 · 74 · 75 · 76 · 77 · 80 · 81 · 82 · 83 · 84 · 85 · 86 · 87 · 88 (I) · 88 (II) · 89 · 90 · 91 · 92 · 93 ·
Electrics (pre-TOPS)	AL1 · AL2 · AL3 · AL4 · AL5 · AL6 · EB1 · EE1 · EF1 · EM1 · EM2 · ES1 · HA · HB · JA · JB ·
Departmental	97 · 97/6 · Eastern · Southern · Other Series ·
Prototypes	15097–15099 · 18000 · 18100 · D0226/D0227 · D0260 · D0280 · D2999 · DHP1 · DP1 · DP2 · GT3 · HS4000 · Janus · Taurus ·
Steam locomotives	98 ·
Ships	99 ·
Lists: Diesel locomotives · Electric locomotives · Miscellaneous locomotives · Diesel multiple units · Electric multiple units · Departmental multiple units ·	

Categories: British Rail diesel locomotives | Bo-Bo locomotives | Railway locomotives introduced in 1958

British Rail Class 25

From Wikipedia, the free encyclopedia

Main page
Contents
Featured content
Current events
Random article
Donate to Wikipedia

Interaction
Help
About Wikipedia
Community portal
Recent changes
Contact Wikipedia

Toolbox

Print/export

Languages
Simple English

The British Rail **Class 25** diesel locomotives were also known as **Sulzer Type 2** and nicknamed ***Rats***, as it was alleged they could be seen everywhere in Britain, and hence were "as common as rats". In total, 327 locomotives of this type were built between 1961 and 1967.

Contents [hide]

1 Background
2 Classification
2.1 Class 25/0
2.2 Class 25/1
2.3 Class 25/2
2.4 Class 25/3
2.5 Class 25/9
2.6 Train Heating Units
2.7 Prototype
3 Preservation and current operation
4 References
4.1 Literature
5 Further reading

British Rail Class 25

Class 25 locomotive stands on Springs Branch Traction Maintenance Depot at Wigan

Power type	**Diesel-electric**
Builder	British Railways' Crewe Works, Darlington Works and Derby Works; Beyer, Peacock & Co.
Build date	1961–1967
Total	327

6 External links

Background [edit]

The Class 24 locomotives were the precursor of the Class 25 design but after the delivery of their first few units it became apparent that the speed ceiling of 75 mph (121 km/h) was unduly restrictive and the provision of a bit more power would be advantageous. In the course of normal development the power output of the Sulzer six-cylinder engine had been increased by 90 hp to give a continuous traction output of 1,250 bhp (930 kW) at 750 rpm by the introduction of charge air cooling and the first locomotives to use this became known as Class 25 locomotives.

The Class 25 locos were primarily designed for freight work, but a significant number were fitted with boilers for heating passenger trains. Throughout the 1970s they could be found at work across the whole of the British Rail network although the Eastern and Southern Regions never had an allocation. Though regular performers into the early 1980s on Crewe–Cardiff passenger trains, they are best known in that respect for their use on the summer Saturday trains to Aberystwyth, a task they relinquished in 1984. The final Class 25 locomotive was withdrawn from service in March 1987.

Classification [edit]

Total produced	327
Configuration	Bo-Bo
UIC classification	Bo'Bo'
Gauge	4 ft 8 ½ in (1,435 mm) Standard gauge
Wheel diameter	3 ft 9 in (1.143 m)
Minimum curve	4.5 chains (91 m)
Wheelbase	36 ft 6 in (11.125 m)
Length	50 ft 6 in (15.392 m)
Width	9 ft 1 in (2.769 m)
Height	12 ft 8 in (3.861 m)
Locomotive weight	71 long tons (72.1 t) to 76 long tons (77.2 t)
Fuel capacity	500 imp gal (2,300 l; 600 US gal)
Prime mover	Sulzer 6LDA28-B
Traction motors	D5151-D5175, four BTH traction motors others: four AEI 253 AY traction motors
Transmission	DC generator, DC traction motors
Multiple working	★ Blue Star
Top speed	90 mph (145 km/h)
Power output	*Engine:* 1,250 hp (932 kW) @750 rpm
Tractive effort	*Maximum:* 39,000 lbf (170 kN) to 45,000 lbf (200 kN)
Train heating	Steam (w hen present)
Locomotive	38 LTf (380 kN)

Classification [edit]

brakeforce	
Train brakes	Vacuum
Career	British Railways
Number	D5151–D5299, D7500–D7677; later 25001–25327
Nicknames	*Rats*
Axle load class	Route availability 4

Class 25/0 [edit]

Number sequence (original) D5151–D5175, (TOPS) 25 001–25 025

The first 25 locos became known as **Class 25/0** and were built at the BR Darlington works using the newer 1,250 hp (930 kW) "B" engine, modified generator assembly and traction motors. This increase in power was obtained from an air/water free flow intercooler fitted between a higher capacity pressure charger and inlet manifold, included within the normal cooling circuit to maintain simplicity. The cylinder head was also modified and strengthened.

The BTH generator, type RTB 15656, was rated as 817.5 kW, 750/545 V, 1090/1500 A at 750 rpm, only slightly different from that used in the earlier Class 24s. (Note all Class 25 locomotives used a generator designated as BTH RTB 15656 but its rating and characteristics changed over time). The generator supplied four BTH 137BX traction motors connected in parallel and rated 245 hp (183 kW), 545 V, 375 A at 560 rpm with a gear ratio of 18:79 (to give a 90 mph (140 km/h) maximum speed). Maximum tractive effort was 39,000 lbf (170 kN) and continuous tractive effort was 20,800 lbf (93,000 N) at 17.1 mph (27.5 km/h), the latter standard for all Class 25s. Power at rail was 949 hp (708 kW), now available between 9.3 and 77.6 mph (124.9 km/h). For the first fifteen locomotives fuel capacity was 520 gallons (design type 25 AV) and the final ten had larger 620 gallon fuel tanks installed (design type 25 BV).

Class 25/1 [edit]

Number sequence (original) D5176–D5232, (TOPS) 25 026–25 082

The **Class 25/1** locomotives were built at BR Darlington and Derby locomotive works. They featured the new AEI 253AY traction motor, a result of the collaboration between BTH, MV and American builder Alco. This smaller, lighter motor was an attempt to market a traction motor to a worldwide audience, especially to the metre gauge lines. For Class 25 locomotives these lighter motors meant the discontinuance of other weight saving measures being built into the design. They were highly rated in an attempt to overcome the loss of

tractive effort normally found on starting. The field divert system was also modified to allow increased capability throughout all the speed ranges.

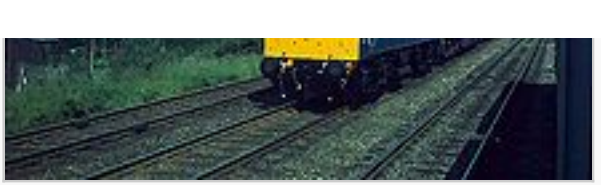
The main generator was a 12-pole machine with the rating changed to 819 kW, 780/545V, 1050/1500A at 750 rpm. (The continuous rating has also been quoted as 819 kW, 630V, 1300A). The four traction motors were now connected as series parallel pairs being rated at 234 hp (174 kW), 315V, 650A at 460 rpm, with a gear ratio 18:67. Pairs of motors connected in series provided a higher maximum tractive effort (usually quoted as 45,000 lbf (200 kN) although 47,000 lbf (210 kN) could be achieved) but the downside being that a series pair connected machine was more prone to slipping than one with an all parallel grouping. Full power was available between 7 and 77.5 mph (124.7 km/h), an improvement over Class 25/0 locomotives with all other ratings unchanged from the earlier series. The traction motor's continuous rating of 650 amps was not far removed from its one hour short term or 'emergency' rating of 680 amps, and this could only be monitored manually. On heavy trains close monitoring of the ammeters was necessary to avoid motor damage. Though the body shell remained similar to D5151 there were a number of refinements. The air horns were relocated to either side of the headcode panel. The cab skirt and body fairing were discontinued, though the support lugs remained. A new driving control panel was fitted. The fuel and water tanks were also redesigned with a fuel capacity of 510 gallons (also quoted in sources as being 500 or 560 gallons).

There were initially two variants of this sub-class. The vast majority were boilered and designated 251 AV. The four without train heating were designated 251 BV. In due course, when it was decided to fit dual braking to a number of locomotives, those previously 251 AV became 251 CX and one of the 251 BV (25032) became 251 DX.

Class 25/2

Number sequence (original) D5233–D5299, D7500–D7597 (TOPS) 25 083–25 247

The **Class 25/2** locomotives featured restyled bodywork and two-tone green livery similar to that carried by the Brush Type 4 (Class 47). The majority were built at BR Derby although some came out of the Darlington works. The redesign principally affected two areas, the cab and the location of the air intakes.



Class 25/2 No.7536 piloting a London express south of Leicester in June 1972

The gangway doors fitted to the earlier examples were rarely used, their presence adding to the complaints of noise and draughts in the cabs. The removal of the air filters from the side air louvers to the cantrail was the result of a comparison carried out at Inverness between a batch of Derby built Type 2s and a batch of BRCW Type 2s (Class 26 and Class 27), the tests targeting the air quality within the engine room. These tests revealed the location of the grilles on the Derby build allowed for much more debris to reach the filters (especially the lower ones), clogging them quicker, leading to poorer air quality within the engine compartment, and so potentially affecting performance and engine wear. With such a large order to be completed it was felt that a redesign of these areas would have a cost savings in the long run, in addition to a better working environment within the cabs, and with a general less cluttered look about the locomotive's exterior.

There were six variants of this sub-class, reflecting that locos were boilered and/or vacuum braked and/or dual braked. Boiler fitted locomotives included the first five (252 AV) and final thirty Class 25/2 (252 DV). Only members of the latter batch were modified for dual brake operation becoming 252 CX with the exception of 25242 that had had its boiler removed and was designated 252 FX. The non-boilered vacuum braked locos were 252 BV and when dual braked became 252 EX.

Class 25/3

Number sequence (original) D7598–D7677 (TOPS) 25 248–25 327

Preserved Class 25 on the Dean Forest Railway

The final batch of locomotives were designated **Class 25/3** and was to be built by BR Derby and Beyer, Peacock and Company of Manchester. However, because of financial problems Beyer, Peacock was unable to complete the final 18 locomotives and these were transferred to BR Derby for construction.

Though these locomotives still carried a RTB 15656 generator, this variant was a ten pole machine with a modified assembly incompatible with earlier equipment. The regulated (full hp) part of

its characteristic was substantially the same as before but the unloading point, that is the point at which full power could no longer be utilised, was altered to 900 A, 910 V (819 kW) from 1,050 A, 780 V (819 kW). Only two stages of field weakening were employed, previous machines had six, and this provided 'full power' at speeds between 7 and 80 mph (130 km/h), and maximum tractive effort was reduced to 41,500 lbf (185,000 N).

The latter half of the 1960s had seen the widespread introduction of solid state electronics and these locomotives incorporated a control system where speed was detected electronically rather than mechanically. A signal from a tachogenerator was used to close contactors in sequence at given speeds to activate the motor's field weakening process, rather than through contacts and relays as in earlier types. The control system ensured the traction motors and main generator were all operated within the continuous rating of the machines except in full field conditions when the driver was able to judge how long to remain in the short-term rating condition. There were two variants of the Class 25/3 sub-class. Early 25/3 AV locomotives were fitted with vacuum brakes and in due course many of these were dual braked and redesignated 253 BX. By the time the last few locomotives were under construction dual braking had become the norm and ten of the last batch from Derby were built new as 25/3 BX locomotives for work out of Willesden on the recently upgraded West Coast Main Line.

Class 25/9 [edit]

At the end of 1985 twelve of the remaining Class 25/3 locomotives were designated as 25/9, the intention being that they would operate on traffic won for the Industrial Minerals Division of Railfreight that included salt for road gritting from the ICI mine at Winsford. The locos were selected from the available pool of Class 25 locomotives in March 1985 with the expectation of three more years of service before *10,000 running hours since last Works attention* would be reached and their maintenance would be concentrated at Carlisle Kingmoor depot. At that point the expected cascade of motive power on BR as a whole would see them replaced by Class 31 locomotives. However, the traffic they were designated for was not captured and in due course the sub-class were withdrawn along with the other members.

Train Heating Units [edit]

Three Class 25/3 locomotives were converted in 1983 for use as mobile generators to provide electric

heating on trains where the hauling locomotive could not supply this. They were given departmental numbers 97250 / 97251 / 97252 (formally 25310 / 25305 / 25314). They were referred to as ETHEL units (Electric Train Heating Ex-Locomotives), and unofficially named Ethel 1, Ethel 2 and Ethel 3. They were painted in a blue/grey livery in an effort to match the coaching stock livery of the day, but this was not too successful. Ethel 1 was withdrawn in 1987, the other two in 1990. All three were scrapped in 1994.

Prototype [edit]

In 1962 Sulzer designed and began development of a prototype diesel engine for higher outputs based on the LDA range. Rated initially at 1,700 hp (1,300 kW) at 850 rpm (with a development potential to 2,000 bhp (1,500 kW) at 850 rpm) it was approximately the same overall size as the 6LDA28 and designated LDA28-R. BR was approached with the idea that one of the Derby Type 2s should be fitted with this engine but development work proceeded slowly and problems with the 12LDA28-C (used on the Class 47 locomotive) diverted resources. In the end development was terminated and the locomotive set aside for its use, D5299, was completed as a standard Class 25/2.

Preservation and current operation [edit]

Twenty Class 25s have survived in preservation,[1] of all sub-types except Class 25/0.

Numbers carried (Current in bold)		Name	Location	Current Status	Livery
D5185	25035	*Castell Dinas Brân*	Great Central Railway	Undergoing Repairs	BR Green (Yellow Warning Panels)
D5207	**25057**	-	North Norfolk Railway	Operational	BR Blue
D5209	**25059**	-	Keighley and Worth Valley Railway	Operational	BR Blue
D5217	25067	-	Battlefield Line Railway	Operational	BR Green (Yellow Warning

			Battlefield Line Railway	Operational	Panels)
D5222	25072	-	Caledonian Railway	Awaiting Restoration	BR Green (Full Yellow Ends)
D5233	**25083**	-	Caledonian Railway	Awaiting Restoration	BR Blue
D7523	25173	*John F Kennedy*	Epping Ongar Railway[2]	Operational	BR Two-Tone Green (Yellow Warning Panels)
D7535	25185	*Mercury*	Paignton and Dartmouth Steam Railway	Operational	BR Two-Tone Green (Yellow Warning Panels)
D7541	25191	*The Diana*	South Devon Railway	Awaiting restoration	BR Green (Yellow Warning Panels)
D7585	**25235**	-	Bo'ness and Kinneil Railway	Yard use (Awaiting wheelset overhaul)	BR Blue
D7594	25244	-	Kent and East Sussex Railway	Awaiting restoration	N/A
D7612	25262	-	South Devon Railway	Operational	BR Two-Tone Green (Yellow Warning Panels)
D7615	**25265**	*Harlech Castle*	Great Central Railway	Undergoing overhaul (Off Site)	BR Blue
D7628	25278	*Sybilla*	North Yorkshire Moors Railway	Operational	BR Two-Tone Green (Yellow Warning Panels)
D7629	25279	-	Great Central Railway Nottingham	Operational	BR Two-Tone Green (Yellow Warning Panels)
D7633	25283	-	Dean Forest Railway	Operational	BR Two-Tone Green (Yellow Warning Panels)
D7659	25309	-	West Coast Railway Company	Undergoing overhaul	BR Two-Tone Green (Yellow Warning Panels)
D7663	**25313**	-	Wensleydale Railway	Undergoing overhaul	BR Blue

D7671	**25321**	-	Midland Railway - Butterley	Operational	BR Blue
D7672	**25322**	*Tamworth Castle*	Churnet Valley Railway	Awaiting repairs	BR Blue Variant

The class returned to the main line in October 2007 when D7628 (25278) worked from the North Yorkshire Moors Railway to and from Whitby station.[3]

Preserved Class 25 on the North Yorkshire Moors Railway

References [edit]

1. ^ List of Class 25s Preserved Diesels.co.uk, Retrieved on 2008-04-08.
2. ^ ""D7523" coming to Epping Ongar Railway". Retrieved 3 September 2011.
3. ^ October 2007 visit to Whitby Class25.info, Retrieved on 2008-04-08.

Literature [edit]

- AEI/Sulzer (1962). *Operating Manual for BR Type 2 Diesel Electric Locomotive Numbers D5000 – D5150 (1160 hp) and D5151 – D5175 1250 hp)*. AEI/Sulzer Ltd.
- AEI/Sulzer (1966). *Operating Manual for BR Type 2 Diesel Electric Locomotive Numbers D5176 – D5299 and D7500 – D7677*. AEI/Sulzer Ltd.
- Marsden, C.J (1985). *Brush-Sulzer Locomotives*. Ian Allan.
- Marsden, Colin J. (1981). *Motive power recognition:1 Locomotives*. Shepperton: Ian Allen Ltd. ISBN 0-7110-1109-5.
- Tayler, A.T.H (1984). *BR Locomotives:2 Sulzer Types 2 and 3*. Ian Allan ISBN 0-7110-1340-3.
- Webb, B (1978). *Sulzer Diesel Locomotives of British Rail*. David & Charles.
- *Rail Express Magazine*, Issues 1 and 2, June/July 1996
- *Ian Allan ABC of British Railways Locomotives*, summer 1966 edition

Further reading [edit]

- McManus, Michael. *Ultimate Allocations, British Railways Locomotives 1948 - 1968*. Wirral. Michael McManus.

External links [edit]

- Caledonian Railway Diesel Group.
- DerbySulzers.com: BR/Sulzer Type 2 locomotives
- Class25.info: Class 25 locomotives In Action
- D7629.com: Class 25 Detailed information, History, Operation

V · T · E ·	**British railway locomotives and miscellany, 1948 to present** [hide]
Diesel shunters	01 · 01/5 · 02 · 03 · 04 · 05 · 06 · 07 · 08 · 09 · 10 · 11 · 12 · 13 · 14 ·
Diesel shunters (pre-TOPS)	11001 · 11104 · 15107 · 13000 · D1/1 · D1/2 · D1/3 · D1/4 · D2/1 · D2/2 · D2/3 · D2/4 · D2/5 · D2/6 · D2/7 · D2/8 · D2/9 · D2/10 · D2/11 · D2/12 · D3/1 · D3/2 · D3/3 · D3/4 · D3/5 · D3/6 · D3/7 · D3/8 · D3/9 · D3/10 · D3/11 · D3/12 · D3/13 · D3/14 ·
	15 · 16 · 17 · 18 · 20 · 21 (I) · 21 (II) · 22 (I) · 23 · 24 · **25** · 26 · 27 · 28 · 29 · 30 · 31 · 33 · 35 · 37 · 38 ·

Main-line diesels:	40 · 41 (I) · 41 (II) · 41 (III) · 42 · 43 (I) · 43 (II) · 44 · 45 · 46 · 47 · 48 (I) · 48 (II) · 50 · 51 · 52 · 53 · 55 · 56 · 57 · 58 · 59 · 60 · 61 · 62 · 65 · 66 · 67 · 68 · 70 (II) ·
Main-line diesels (pre-TOPS)	10000–10001 · 10100 · 10201–10203 · 10800 · D8/1 · D8/2 · D10/1 · D10/2 · D10/3 · D11/1 · D11/2 · D11/3 · D11/4 · D11/5 · **D12/1** · D12/2 · D12/3 · D13/1 · D14/1 · D14/2 · D15/1 · D15/2 · D16/1 · D16/2 · D17/1 · D17/2 · D20/1 · D20/2 · D22/1 · D22/2 · D23/1 · D25/1 · D27/1 · D33/1 ·
Electrics	22 (II) · 70 (I) · 71 · 72 · 73 · 74 · 75 · 76 · 77 · 80 · 81 · 82 · 83 · 84 · 85 · 86 · 87 · 88 · 89 · 90 · 91 · 92 · 93 ·
Electrics (pre-TOPS)	AL1 · AL2 · AL3 · AL4 · AL5 · AL6 · EB1 · EE1 · EF1 · EM1 · EM2 · ES1 · HA · HB · JA · JB ·
Departmental	97 · 97/6 · Eastern · Southern · Other Series ·
Prototypes	15097–15099 · 18000 · 18100 · D0226/D0227 · D0260 · D0280 · D2999 · DHP1 · DP1 · DP2 · GT3 · HS4000 · Janus/Taurus ·
Ships	99 ·

Lists: Diesel locomotives · Electric locomotives · Miscellaneous locomotives · Diesel multiple units · Electric multiple units · Departmental multiple units ·

Categories: British Rail diesel locomotives | Bo-Bo locomotives | Beyer, Peacock locomotives | Railway locomotives introduced in 1961

BR. 33003/104
Revised August, 1964

1,250 H.P. BR/SULZER/A.E.I.
TYPE 2 B-B DIESEL ELECTRIC
LOCOMOTIVES
Nos. D.5176-D.5299 &
D.7500-D.7597

DRIVING INSTRUCTIONS INCLUDING STANDARD PREPARATION AND DISPOSAL DUTIES

DRIVING INSTRUCTIONS FOR OPERATING TYPE 2 B.R.—SULZER—A.E.I. 1,250 H.P. DIESEL ELECTRIC LOCOMOTIVES NOS. D.5176 - D.5299 AND D.7500 - D.7597.

LOCOMOTIVE DATA

Type	BB.
Weight in running order	73 tons 15 cwts.
Tractive effort: Maximum	45,000 lbs. at 2,340 amps.—main generator.
Continuous	20,800 lbs. at 17.1 m.p.h. 1,300 amps. —main generator.
Rail h.p. at continuous rating	949 h.p.
Total wheelbase	36ft. 6ins.
Bogie wheelbase	8ft. 6ins.
Wheel diameter	3ft. 9ins.
Pivot centres	28ft. 0ins.
Width overall	8ft. 11⅛ins.
Length overall	50ft. 6ins.
Height overall	12ft. 8ins.
Minimum curve negotiable	4½ chains.
MAXIMUM PERMITTED SPEED	90 m.p.h.
Fuel tank capacity	560 galls.
Engine lubricating oil capacity	100 galls.
Engine coolant water capacity	187 galls.
Radiator	Serck type.
Boiler water tank capacity	580 galls.
Brakes	D. & M. type, compressed air and handbrakes on the locomotive. Vacuum brake equipment giving proportional braking on the locomotive.
Sanding equipment	Compressed air operated.

POWER EQUIPMENT

6-cylinder diesel engine	Sulzer 4-stroke type 6LDA28B. 1,250 h.p. at 750 r.p.m.
Direction of rotation, looking on the free end of the engine.	Clockwise.
Cylinder bore	280mm. = 11.02ins.
Cylinder stroke	360m.m. = 14.17ins.
Cylinder firing order	1, 5, 3, 6, 2, 4.

Fuel injector nozzle type	C.A.V. B.D.L. 145S. 6313, 8 holes x 0.45mm.
Fuel injector holder type	C.A.V. B.K.B. 200T. 5033.
Pressure at which fuel injector nozzles should be set	3,670lb./sq.in. (250 atmos).
Fuel pumps	C.A.V. B.P.F. IX 180S 6445.
Main generator	A.E.I. type R.T.B. 15656 self ventilated. D.C. 12 pole, shunt wound, continuous rating 735 Kw. at 750 r.p.m., 1,400 amps at 525 volts.
Auxiliary generator	A.E.I. type R.T.B. 7440. D.C. 8 pole, shunt wound, continuous rating 50Kw. 110 volts at 500/750 r.p.m. 32Kw. 110 volts at 325 r.p.m.
Traction motors (4)	A.E.I. type 253A.Y. 4 pole, force ventilated, continuous rating 650 amps., 330 volts, 490 r.p.m. Shaft h.p. 248. 1 hr. rating 680 amps. 315 volts, 455 r.p.m. Shaft h.p. 245.
Traction motor gear ratio	18/67.
Blower motor	A.E.I. continuous rating 110 volts, 103 amps. 12.2 h.p. at 2,600 r.p.m.
Batteries	D.P. 48 cells type R.K.144.
Lighting circuit	110 volts.
Radiator fan	Motor driven:- fan motor 110 volts 85 amps. 1,400 r.p.m. 10.5 h.p.
Exhausters (2)	Reavell FRU 5.25" x 10"—motor driven. Northey type 125 REFM on locomotives D.5233-D.5299 and D.7500-D.7597.
Air compressor (1)	Westinghouse E.C.38B.—motor driven.
Sulzer combined unit: water circulating pump, lubricating oil priming pump and fuel transfer pump.	Driven by one electric motor, A.E.I. type D.Y.2417B., 110 volts, 7.5 h.p.
Carriage warming boiler	Stone Vapour type L.4610.

DRIVER'S CONTROLS IN EACH CAB

1. Master key (removable).
2. Reverser handle—positions marked: OFF, REV., E.O., FOR.
3. Power handle, marked: OFF, ON, ¼, ½, ¾, FULL.
4. Engine "Start" button.
5. Engine "Stop" button.
6. Rear horn push button (1 note).
7. Horn control levers (2 notes) 2.
8. Tail light switches.
9. Instrument panel and body light switches.
10. Driver's instrument light dimmer.

11. Boiler indicator dimmer.
12. Route indicator setting and selector handles.
13. A.W.S. key (removable).
14. A.W.S. isolating switch (normally sealed).
15. A.W.S. reset button.
16. Fire extinguisher release handle.
17. Cab preheat and main heat switches.
18. Windscreen wipers (2) and control valves.
19. Air brake handle.
20. Vacuum brake handle.
21. Driver's safety device treadle.
22. Driver's safety device hold-over button.
23. Sanding pedal.
24. Handbrake wheel.
25. Fire alarm system test button (No. 2 cab only).
26. Fire extinguishers (hand).
27. Anti-wheel slip button—incorporated in power handle.
28. Heater and demister control.
29. Cooker and switch (No. 2 cab only).

INSTRUMENTS AND GAUGES IN EACH CAB

1. Main reservoir air pressure gauge.
2. Air brake gauge (Bogie 1 and 2).
3. Vacuum gauge (duplex).
4. Speedometer.
5. Traction ammeter.
6. Engine stopped indicator (red light).
7. Wheel slip indicator (amber light).
8. Fault indicator (blue light).
9. A.W.S. indicator.
10. C.W.A. steam pressure gauge.
11. Fire alarm bell.
12. Boiler indicator light (white).
13. Handbrake position indicator.

GAUGES FITTED IN ENGINE ROOM/GENERATOR COMPARTMENT

1. Engine water temperature gauge.
2. Engine water pressure gauge.
3. Engine speed indicator (Tachometer).
4. Engine oil temperature gauge.
5. Engine oil pressure gauge.

6. Regulating air pressure gauge.
7. Exhaust temperature gauge (multi-point).
8. Charging air pressure gauge.
9. Battery charging ammeter.
10. Blower motor stopped indicator.
11. Water pressure failed indicator.
12. Engine oil pressure failed indicator.
13. High water temperature indicator.
14. Earth fault indicator.
15. Control air pressure gauge.
16. Engine hour recorder.

CONTROLS IN ENGINE ROOM/GENERATOR COMPARTMENT

1. Control equipment cut-out switch.
2. Traction motor cut-out switches.
3. Earth fault locating switch (sealed).
4. Engine "local" start pushbutton.
5. Braked/Unbraked switch.
6. Control circuit breaker. C.B.
7. Exhauster switches Nos. 1 and 2.
8. Engine fault switch.
9. Radiator fan switches.
10. Boiler isolating switch (in boiler room).
11. Control cubicle light switch.
12. Field divert isolating switch.
13. Battery isolating switch.
14. Vacuum release valves (2).
15. Vacuum isolating cock (deadman's device).
16. Main fire extinguisher cylinders and safety pins (3).

Miniature circuit breakers

C.B.10. Hotplate.
C.B.11. Lighting.
C.B.12. Lighting sockets.
C.B.13. A.W.S.
C.B.15. Fire-alarm.
C.B.19. Cab heaters.

CONTROLS AND GAUGES OUTSIDE THE LOCOMOTIVE

1. Battery isolating switch.
2. Main lighting supply switch (shed-off-loco.).

3. Fire extinguisher release handle.
4. Mileage recorder.
5. Main fuel tank contents gauge (2).
6. Boiler water tank gauge (2).

ISOLATING COCKS

On Brake Cubicle (looking towards No. 1 end).

1a. Cock adjacent to lower rail of cubicle the front handle isolates air from No. 2 triple valve to bogie.

1b. The rear handle isolates air from No. 1 triple valve to bogie (top triple valve is No. 2).

2. Cock on horizontal pipe 1ft. 0ins. up from floor level and 1ft. 0ins. from front of cubicle—isolates air supply to relay valve. (Straight air brake).

3a. Cock on horizontal pipe leading into No. 1 triple valve isolates air supply to triple valve.

3b. Cock on horizontal pipe leading into No. 2 triple valve isolates air supply.

4. Cock in vertical pipe in front centre of cubicle isolates vacuum system from both triple valves.

5. There are two cocks at the top left hand corner of cubicle. The cock to the left hand is the compressor governor isolator and the cock on the right hand is the air governor isolator.

6. There are two cocks at floor level on the right hand side of the cubicle. These isolate No. 1 or No. 2 bogie straight air feed from relay valve.

7. Isolating cock to driver's safety device valve from train pipe is adjacent to the cocks shown in Item 6 above.

8. Cock in corner of engine room adjacent to intermediate engine room door is the main air isolating cock.

9. No. 1 end Sander air supply isolating cock is under trap door against bulkhead in No. 1 cab.

10. No. 2 Sander air supply isolating cock is under main frame below cab No. 2 end (driver's side).

11. Isolating cock for warning horns and windscreen wipers for respective cabs are behind left hand panel of Driver's desk.

12a. Two cocks are adjacent to engine instrument panel on the right hand side. The top cock isolates air supply to control air reducing valve.

12b. The lower cock isolates control reservoir from control system.

13. On the left hand side half way through the engine room a cock is provided to isolate the air pressure reducing valve on the refuelling system.

FUSES

Fuses on Control Frame

F.1.	Battery	Capacity	100	amp.
F.2.	Water and oil pump set	„	100	„
F.3.	Compressor	„	100	„
F.4.	No. 1 exhauster	„	80	„
F.5.	No. 2 exhauster	„	80	„
F.6.	Traction motor blower motor	„	160	„
F.7.	Radiator fan motor	„	160	„
F.8.	Auxiliary generator field	„	15	„
F.9.	Auxiliary Generator Relay, reverse current relay, auxiliary generator voltmeter terminals and exciter field.	„	15	„
F.14.	Main generator voltmeter terminals	„	5	„
F.16.	Train heating boiler control	„	30	„
F.17.	Main generator separate field	„	40	„
F.18.	Main generator self field	„	15	„

SPARE FUSES

No.		Capacity	No.		Capacity
2	—	160 amp.	1	—	40 amp.
2	—	100 „	1	—	30 „
2	—	80 „	2	—	15 „
2	—	60 „	2	—	5 „

CHANGING FUSES

In the event of a fuse failure, one of the spares carried may be used, but care must be taken that it is one of the same capacity as the one which is defective.

The fuses can be identified by their markings which are labelled on the 5, 15, 30, 40, 50 and 60 amp fuses and stamped on the end of the larger sizes. These fuses are all of the "cartridge" type. A blown fuse can usually be detected by a burnt patch on the body of the fuse cartridge. Test all suspected fuses and replacements on the fuse tester which is located on the control cubicle fuse panel.

The following procedure should be adopted when changing fuses:-

1. Stop the engine, then place battery isolating switch to OFF.
2. Take out suspected fuse.
3. Hold fuse by centre portion, place it across tester contacts which are alive. If correct the lamp will light. (Do not touch the Fuse Tester terminals by hand).
4. Secure replacement fuse in position.
5. Place battery isolating switch to ON after replacing fuse.
6. All fuses changed must be reported.

DRIVER'S DAILY DUTIES

1. Obtain master, A.W.S., and door keys.
2. Check fuel and water contents level shown on gauges.
3. Make sure that the jumper plugs are fully home and locked in the dummy sockets, and that the vacuum, air and C.W.A. hoses are secure and the cocks correctly positioned.
4. Check that all circuit breakers on control cubicle are in the ON position.
5. Test fire alarm system by operating test push button in No. 2 cab.
6. Check that the detonator cases are intact and the hand fire extinguishers in position. Set route indicators as required.
7. Check position of cab pre-heat and main heat switches.
8. Report all known defects.

NOTE.—All pipes are coloured for identification to assist when reporting defects, etc.

Colour Identification of Pipe Lines

Line	*Colour*	*Symbol*
Air, compressed	White	A.C.
Vacuum	White	A.V.
Air ventilation exhaust	White	A.E.
Air ventilation inlet	White	A.I.
Drainage	Black	
Electrical	Light Orange	
Fire installations	Signal Red	
Oil, diesel fuel	Light Brown	O.D.
Oil, lubricating	Salmon Pink	
Steam	Aluminium	
Water, engine cooling	French Blue	
Water, C.W.A. feed	Grass Green	
TIA water softening	Light Grey	

STANDARD PREPARATION DUTIES

Driving from No. 1 Cab

1. **At Locomotive**

   Open No. 1 cab door, enter driving cab and deposit personal belongings, and equipment.

2. **External Examination**

   Check jumper cables are secure in the plugs No. 1 end.

   Close battery isolating and lighting switches, and ensure no depot pipes or electric lines are attached.

   Check boiler water tank and main fuel tank content gauges.

   Obtain tail lamp from trailing cab and place in position. Check jumper cables are secure in the plugs at No. 2 end.

   Proceed to driving cab via the other side of the locomotive.

3. **In Driving Cab**

Check handbrake on.

Check brake handles in neutral or release position as case may be.

Check detonator case intact and hand fire extinguishers **in position.**

Take control keys (master key and carriage key).

4. **Proceed towards Trailing Cab and**

Check water levels in radiator settling tanks.

Check position of boiler fuel valve and emergency fuel tank valve (should be sealed "closed"). Check over-spill supply valve open.

Check boiler main switch is OFF.

Check that the safety pins are removed from the main fire extinguisher cylinders, if not remove them.

Close exhauster switches.

Check the braked/unbraked switch is in "braked" position.

Close any other subsidiary switches necessary and check that all circuit breakers on control cubicle are in the ON position.

5. **In Trailing Cab**

Check brake handles are in release or neutral position as the case may be.

Check hand fire extinguishers are in position.

Position master key, then move reversing handle to E.O. position to start pump set and (after one minute) start engine.

Check detonator case is intact and test fire alarm system by operating test button (in No. 2 Cab only).

Set route indicators to blank aspect if necessary.

Check windows and doors are closed.

Apply power brakes by operating the VACUUM BRAKE handle.

Place reverser handle to OFF, then remove master key, leaving the engine running. Replace vacuum brake handle to "running" position then release the hand brake.

6. **Proceed towards Driving Cab and**

En route make cursory examination of the engine and boiler compartments for obvious defects, close engine room doors.

7. **Enter Driving Cab**

Insert master key then move the reversing handle to E.O. position.

Insert A.W.S. key and move it to ON position then depress and release the A.W.S. reset button.

Reset the route indicators if necessary.

Check air pressure and test brakes. To test the brakes make a service application and release with the driver's straight air brake valve and check that the brake cylinder gauge responds accordingly. (Brake cylinder pressure is 65-70 lbs./sq. in.). Place the air brake handle into the RELEASE position, then test the brakes by making a vacuum brake application and check that

the air brake cylinder pressure rises after the train pipe vacuum has fallen.

Move reverser handle to "Forward". Release handbrake and at the same time check operation of the driver's safety device.

Sound warning horns, including the high tone horn to the rear.

STARTING THE ENGINE

1. Check that the hand brake is ON in the driving cab; and OFF in the trailing cab.
2. Place the air brake handles to **release** position.
3. Place the vacuum brake handles into **running** position.
4. Place the A.W.S. key into control box and place to ON (handle up) **in the driving cab.**
5. Place the master key into controller and turn to unlocked position.
6. Place the reversing handle in "E.O." position; this will automatically start the combined pump set (water pressure 10-12 lbs.).
7. After one minute push the engine starting button firmly to start and hold it there until the engine fires, and for several seconds after the "Engine Stopped" red light goes dim. If coupled for multiple working the light will go dim when the last engine has started.

   A local "start" button is provided on the engine instrument panel in the engine room and can be used if desired as an alternative, **but when working in multiple this "Start" button will only start one engine.**

NOTES.—(a) Under no circumstances must the starting button be kept depressed if the engine fails to turn over within 15 seconds. If the engine turns but does not fire after approximately 30 seconds and no cause is apparent to the driver, the matter must be reported.

(b) When the engine is running and the reverser is in the E.O. position no power circuits are made, but the auxiliary generator provides power for the auxiliary machines and battery charging.

MULTIPLE LOCOMOTIVE WORKING

These locomotives have been designed so that they are capable of being run in multiple with locomotives carrying the "Blue Star" coupling symbol.

Two or three locomotives can be coupled together and driven from any one cab.

To effect this the master controllers and their associated equipments are connected by train lines. Each locomotive will, therefore, respond to any controller unless it has been deliberately rendered inoperative by opening its corresponding equipment cut-out switch (engine control switch).

THE MAXIMUM SPEED OF THE COUPLED LOCOMOTIVES MUST NOT EXCEED THAT SPECIFIED FOR THE LOCOMOTIVE WITH THE LOWEST MAXIMUM SPEED.

In the event of the failure of one locomotive it can be isolated completely without taking the locomotive off the train. The battery isolating switch must be left at ON if driving from the defective locomotive, but the locomotive which has failed must be taken off the train at the next convenient stopping point or in any case under TWO hours from the time of the failure. The steam generator, if in use, MUST be shut down on the defective locomotive.

COUPLING UP LOCOMOTIVES FOR MULTIPLE WORKING

1. On buffering up for couplings, apply the AIR BRAKE, then PLACE THE REVERSING HANDLE TO OFF POSITION AND TAKE THE MASTER KEY OUT OF THE CONTROLLER ON EACH LOCOMOTIVE.
2. Couple up shackles and all pipe connections required and open cocks then operate the VACUUM BRAKE handle to apply the power brakes to hold the locomotives.
3. Couple up the jumper cables required and ensure that the plugs are fully home and locked in their sockets and that the pipe connections are correctly coupled and the cocks open.

On Trailing Locomotives

Remove the master key and A.W.S. key. Check the position of the braked/unbraked switches and isolate the vacuum exhausters.

In All Trailing Cabs

The air and vacuum brake handle must be placed into the release and running positions respectively, checking the air brake cylinder pressure to ensure the brakes are still applied. Check that the hand brakes are released.

On the Leading Locomotive

Place the air brake handle to the ON position, check that the hand brake is released then place the exhauster switches to ON, check position of braked/unbraked switch then place A.W.S. and master key into position in the leading cab to obtain control of the units.

NOTE.—Only one master key may be used when coupled for multiple locomotive working.

INSPECTION OF JUMPERS & HOSE PIPES

Make sure that the jumper plugs are fully home and locked in their sockets and that the pipe connections are correctly coupled and the cocks open.

UNCOUPLING LOCOMOTIVES AFTER MULTIPLE UNIT WORKING

1. Operate the VACUUM BRAKE handle to apply the power brakes to hold the locomotives, THEN PLACE THE REVERSING HANDLE TO **OFF** POSITION AND TAKE THE MASTER KEY OUT OF THE CONTROLLER.

2. Disconnect the jumper cables and secure them in the position provided.
3. Close cocks and uncouple all pipe connections and screw shackle.
4. Replace master key on leading locomotive to regain control. On trailing locomotive(s) the A.W.S. and the master key will require placing in position and the exhausters switched on before the locomotive is moved. Check position of braked/unbraked switches.

TO START THE LOCOMOTIVE

1. **Before attempting to move the locomotive** make sure that the main reservoir air pressure is 85/100 lbs. per sq. in. and that 21 ins. of vacuum is being maintained by the exhausters.
2. Place the braked/unbraked switch into the appropriate position. When running "light locomotive" the switch MUST be placed into the braked position.
3. Check that the handbrake is released.
4. Place a foot on the Deadman's pedal and depress it, then move the reverser into FORWARD or REVERSE for the desired direction of travel.
5. **To move the locomotive,** release the brakes. If the straight air brake is applied to hold the locomotive on a rising gradient release it simultaneously with the movement of the power handle to the ON position, then pull the main power handle to ON, then pull the handle SLOWLY towards the Mid position until the train moves and then continue to advance the handle towards the FULL POWER position until the requisite power is obtained. The generator current should not be allowed to exceed 2340 amperes when accelerating. Do not leave the power handle in a high Power Position if the train does not start within a few seconds. Under wet rail conditions, slipping may occur before the controller is fully open. In that case proceed as for Amber light—wheel slip.

WHILST RUNNING

Engine Speeds

The diesel engine runs at approximately 325/365 r.p.m. at idling increasing to 750 r.p.m. at maximum power. By moving the power handle between ON and FULL, the power controller position of the engine governor is progressively opened or closed according to direction of movement, viz. up or down, and the diesel engine speed will be held steady so long as the power handle setting remains unchanged.

Indicator lights in Cab

Fault	(Blue)
Engine stopped	(Red)
Wheel slip	(Amber)

Indicator Light Failure

If an indicator light is out and no apparent cause can be found this may be due to a bulb failure and the indicators in the other driving cab should be checked. If these are functioning normally the locomotive can proceed.

Amber Light—Wheel Slip

Wheel slip is indicated by brightening of the "amber light." To correct this, press the "anti-slip-brake" button on the instrument panel for approximately 2 seconds and then release. If this does not check the wheel spin, press the anti-slip button again, ease back the power handle until the light dims, and then release the button. The power handle then can be advanced slowly.

If slipping still occurs, PUT THE POWER HANDLE TO ON BEFORE OPERATING THE SANDERS, then accelerate again as required.

Red Light—Engine Stopped

The engine is shut down automatically in the case of the following defects and the red light becomes bright:-

(a) Low oil pressure
(b) Low water pressure
(c) Engine over-speeded
(d) No fuel
(e) Control circuit breaker opened the light will go out.
(f) Control equipment cut out switch opened the light will remain permanently dim.

Blue Light—Fault

The blue light becomes bright in the case of the following faults:-

(a) High water temperature
(b) Blower motor failure
(c) Earth fault relay tripped (The fault light will go dim again when the power handle is returned to OFF).
(d) Loss of main reservoir air pressure or vacuum.

Earth Fault

Power will be cut off and the fault light (blue) will shine brightly. Return power handle to OFF, then open up slowly. If the fault is persistent operate the earth fault isolating switch. If necessary isolate the traction motors concerned i.e. Nos. 1 and 4 or 2 and 3. In either event the locomotive must be taken out of traffic.

White Light—Steam Generator Alarm

Should the steam generator indicator light become bright this indicates that a fault has developed in the boiler equipment. When the light is out this indicates one of the following:-

(a) Steam generator switch off
(b) Switch tripped on electrical fault
(c) Indicator circuit or lamp failed.

Water Temperature

The fault light (blue) will glow bright and the high water temperature indicator will show on the control cubicle if the water temperature is too high but the engine will not shut down. The power handle should be eased back and the engine run at reduced load until the indicator shows normal. If the fault persists, at the next convenient stopping point:-

(a) Check engine water temperature gauge (Maximum temperature 185°F.).

(b) Check that radiator fan is running. If not, place the low fan switch to "hand" then 2 seconds later place the high fan switch to "hand." If radiator fan still does not run, check fan fuse in cubicle.

(c) Feel pipes connected to thermostatic valve. If pipes running to the radiator are not both hot, break seal on thermostatic valve and turn to DIRECT. KEEP WATER PUMP RUNNING.

Load Regulator

At all engine speeds the load regulator varies the generator excitation so that maximum available power for the power handle position selected is continuously supplied to the traction motors without overloading the engine.

To increase the locomotive tractive effort speed range (at all engine speeds) traction motor field diversion is provided and controlled automatically by the load regulator.

Low Oil Pressure

If the engine lubricating oil pressure drops below 12 lbs. sq. in. the engine is shut down automatically and the engine stopped light will show "bright." Check oil level; if normal, try to re-start engine not more than THREE times. If the engine starts, check oil pressure reading on the gauge fitted on the engine.

Battery Charging

If, after checking the battery ammeter which is fitted on the control cubicle, it is found that the battery is being discharged, the engine should be kept running and the matter reported immediately for attention within TWO hours or the locomotive will have to be taken out of traffic.

Brake Application

The brakes, locomotive and train, are applied by operating the driver's vacuum brake valve. A vacuum brake application can only be made when the exhausters are running. The air brake valve does NOT apply the vacuum brake. The brakes must not be applied whilst the main power handle is in a POWER ON position, except when buffering up to couple to a train or another locomotive, **when only low power should be used.** The vacuum governor will cut off power to the traction motors whenever the vacuum falls below 12½ ins. Power cannot be restored until a vacuum of 15 ins. has been created.

Engine Failure

In the event of a complete engine failure the Engine equipment cut-out switch must be opened. Then the brakes can be operated on the defective locomotive if coupled in multiple or tandem with a locomotive carrying the "blue star" coupling symbol.

If coupled to a steam locomotive the power brakes cannot be operated. The control keys must be removed, the vacuum and air brakes MUST be released, and ALL air pressure blown out of the air reservoirs by opening drain cocks. The disabled locomotive must be towed with the hand brake only in operation. The vacuum pipes may be coupled through, then the locomotive becomes a piped vehicle, providing that the vacuum isolating cock which controls the driver's safety device is closed.

In the event of a fault on the engine which does not incapacitate the engine entirely (e.g. supercharger failure or blown gasket, the "engine fault" switch on the fault relay panel should be set to "fault." To do this it is necessary to withdraw the locking pin or break the seal if fitted). This switch limits the electrical power output of the generator and thus prevents overload of the restricted output of the engine. The occurrence should be reported.

Driver's Safety Device

If the driver's safety device treadle is released when the power handle is in power position the power is cut off and a brake application is made after 5-7 seconds' delay. The diesel engine continues to run at its idling speed. When a driver's safety device application takes place, the following action must be taken to regain control:-

(a) Return the power handle to OFF.

(b) Depress the driver's safety device treadle. As soon as the brakes are released, locomotive may again be re-started normally, as shown under "to start the locomotive," item 5.

NOTE: In order that the locomotive can proceed, should there be a complete failure of the driver's safety device involving loss of vacuum, it will be necessary to close the vacuum isolating cock provided on the brake cubicle. This cock should be closed in emergency only and a second man obtained to ride with the driver throughout the time it is closed whilst the locomotive is in motion. The failure must be reported as soon as possible.

TO STOP THE LOCOMOTIVE

1. Return the power handle to OFF.
2. Apply the brakes.

TO REVERSE THE LOCOMOTIVE

1. Return the power handle to OFF.
2. Apply the brakes to hold the locomotive stationary.

   DO NOT ATTEMPT TO REVERSE WHEN THE LOCOMOTIVE IS MOVING.
3. Move the reversing handle to the position required.
4. Release brakes, then operate the power handle as required.

CHANGING ENDS

1. Apply the brakes by operating the driver's VACUUM BRAKE VALVE.
2. Place the reversing handle to OFF position (this stops the exhausters). Do not stop the engine(s).
3. Remove the master and A.W.S. keys.
4. Place the vacuum brake handle into the RUNNING position.
5. Place the air brake handle into the RELEASE position. Check air brake cylinder pressure gauge to ensure that the brakes are still applied.
6. When working in multiple ISOLATE THE EXHAUSTERS on the trailing locomotive(s) by opening the exhauster switches.
7. Proceed to cab from which driving is to be carried out **and place** the air brake handle to the "ON" position and leave in that position until all control keys have been placed into position (when working in multiple the exhauster switches in the leading locomotive must be placed to the ON position).

   The position of the brake valves in the trailing cab should be: Vacuum brake handle in RUNNING position, and the air brake handle in RELEASE position.

   When working in multiple the VACUUM BRAKE HANDLES MUST BE IN RUNNING AND THE AIR BRAKE HANDLES IN RELEASE POSITION IN ALL TRAILING CABS.

   NOTE: Cab main heat switch must be placed into the correct position in the trailing cab if it is required to heat the leading cab:-
   For example, if leaving No. 2 cab the main heat switch must be placed to No. 1 cab position. On reaching No. 1 cab the switch required must be placed to No. 1 cab position.

TO STOP THE ENGINE

1. Check that the main power handle is at OFF.
2. Return the reversing lever to the OFF position then press the engine stop button.

   NOTES:

   (a) Do not shut the engine down until the locomotive is brought to a stand.

   (b) If the engine stops when on full load for any reason (except in the case of fire) when the train has been brought to a stand place the reversing lever to E.O. position and leave it there for two minutes to enable the triple pump set to run to reduce the engine coolant temperature, then place the reversing handle to OFF position.

   (c) **Fire protection**
   After bringing the train to a stand in the event of fire IMMEDIATELY RETURN THE REVERSING HANDLE TO OFF POSITION, THEN STOP THE ENGINE. This action stops all the auxiliary equipment on the locomotive (see page 17).

STANDARD DISPOSAL INSTRUCTIONS

1. Stop the locomotive by applying the VACUUM BRAKE. Move the reversing handle to OFF, then immediately stop the engine and remove the master key.
2. Check that the air brake handle is in "release" position, then return the vacuum brake handle to "running" position. Close cab windows.
3. Proceed to trailing cab through the engine room, en route making a cursory examination of the power unit.
4. In trailing cab:-
   Apply handbrake and check that windows and doors are closed.
5. Return to driving cab, collect A.W.S. and master keys and descend to ground.
6. Open battery isolating switch and place the lighting changeover switch to OFF position.

TOWING THE LOCOMOTIVE

When it is not possible to run the diesel engine, the locomotive can be towed in multiple with a locomotive carrying the "blue star" coupling symbol or as a tandem unit with the power brakes in operation, with the equipment cut out switch at OFF position and the master and A.W.S. keys removed.

If towed by a steam locomotive, the vacuum and air brakes MUST be released and ALL air pressure blown out of the air reservoirs, the hand brake only is left in operation. The power handle must be in the OFF position, the reversing handle at OFF position, the master and A.W.S. keys removed and the battery switch at OFF. The vacuum pipes may be coupled through, then the locomotive becomes a piped vehicle, providing that the vacuum isolating cock which controls the driver's safety device is closed.

FUEL SUPPLY TO THE DIESEL ENGINE

A motor-driven pump (pressurising unit) supplies the fuel oil under pressure to the injector fuel pumps direct from the main tank, any surplus fuel being by-passed back to the fuel tank via the emergency service tank, the emergency service tank therefore being kept in a full state.

In the event of the failure of the main fuel transfer pump, the locomotive can be operated by gravity fuel feed from the emergency service tank containing 10 gallons of fuel, which should be adequate for 10 to 12 minutes' running.

To operate with the emergency service tank in use the following procedure should be carried out:-

(a) Open the gravity feed supply valves located immediately below the tank.

(b) Close pressure feed valve.

(c) Open by-pass cock on fuel fine filter, using the special key provided.

This will allow the gravity feed to pass by the fuel filter to the engine fuel bus line.

AUDIBLE FIRE WARNING SYSTEM

An audible fire warning system forms part of the locomotive equipment.

The system is arranged to operate a fire alarm bell in each cab in the event of fire occurring. To test the operation of the warning system a test button is provided in No. 2 driving cab and listen for the bell in the driving cab. This must be done by each driver on taking charge of the locomotive.

FIRE PROTECTION

For dealing with fires in the engine room a CO_2 gas system with electrical detectors is installed. To release the extinguishers it is necessary to operate the fire extinguisher control in the driving cab, or on the body side.

If the fire bell rings, investigate the cause.

Should a fire occur on the locomotive whilst in motion—

(a) STOP THE TRAIN

(b) IMMEDIATELY RETURN THE REVERSING HANDLE TO OFF POSITION, THEN STOP THE ENGINE. This action stops all the auxiliary equipment on the locomotive, excepting the steam heating generator.

(c) SHUT DOWN THE STEAM HEATING GENERATOR IF IN SERVICE.

N.B.—In all cases THE ENGINES MUST BE STOPPED before operating the main fire extinguishers, otherwise the CO_2 gas will be extracted from the engine room to atmosphere by the generator fan, etc., or drawn into the turbocharger.

Before operating the main extinguishers LOOK FOR THE FIRE TO ENSURE THAT A FALSE ALARM has not been given by a fault in the alrm system.

To avoid using the main extinguishers in the event of a small outbreak of fire, or for an external fire, hand extinguishers are provided in each driving cab.

In the event of the main or portable extinguishers being operated by accident or in the case of fire, the matter MUST be reported as soon as possible.

The CO_2 extinguishers should only be used against internal fires, if used externally the gas very rapidly dissipates and its efficacy is seriously reduced.

The C.T.C. extinguishers should only be used against external fires, they MUST NOT be used against internal fires.

Do not leave waste, cloths or litter of any description lying about in the engine room as these can be a contributory cause of fire.

Naked lights should not be used in or around these locomotives

for any purpose **except in the driving cabs** where smoking is permitted.

CAUTION: Carbon dioxide is non-poisonous, but if breathed in excessive quantities it is asphyxiating. If a person is overcome by breathing this gas he should be removed quickly to the fresh air and artificial respiration applied as for electric shock.

VACUUM BRAKE DEFECTS—PROCEDURE

When a test is to be made in connection with a vacuum brake defect, the following procedure is to be adopted:-

Vacuum Brake Efficiency Test

The diesel engine MUST be running to operate the exhausters for this test.

Take the vacuum hose at No. 1 end off the dummy coupling and move driver's vacuum brake to RELEASE position, watch the vacuum gauge and if more than 3 ins. of vacuum is obtained it is an indication that there is a stoppage in the apparatus which must be located and removed. Replace pipe at No. 1 end and repeat operation at No. 2 end. Create 21 ins. of vacuum, then place reversing handle to OFF position, and note the time taken for the vacuum to fall to 12 ins. in the train pipe. If this is less than 30 seconds, it is an indication that undue leakage is occurring and this must be found.

(a) **Driver's Vacuum Brake Valve in "Running" Position**

Take the hosepipe off the dummy coupling at one end of the locomotive and place the special disc with a $\frac{1}{16}$ in. diameter leak hole on the end of the hosepipe. Place the driver's brake valve in the RUNNING position and ascertain if 21 ins. of vacuum can be created and maintained.

(b) Take the hosepipe off the dummy coupling at one end of the locomotive and place the special disc with a $\frac{1}{4}$ in. diameter leak hole on the end of the hosepipe, then with the driver's brake valve in RELEASE position ascertain if 21 ins. of vacuum can be created and maintained.

NOTE: The brake test should be carried out from each driving cab.

WARNING HORNS

When sounding horn to comply with rule 127 and the appendix instruction, operate the lever in such a manner as to give the two note sounds that these horns are designed to emit. This is of the utmost importance and if the horn is defective it must be reported immediately.

NOTE: This locomotive is fitted with a push button on the driving desks to enable a single note to be sounded on one horn at the trailing end.

GAUGES AND INSTRUMENTS IN STEAM GENERATOR COMPARTMENT

1. Generator steam pressure gauge.
2. Main pipe steam pressure gauge.
3. Generator fuel pressure gauge.
4. Fuel nozzle pressure gauge.
5. Water pressure gauge.
6. Atomisation air pressure gauge.
7. Air damper indicator.
8. Water flow indicator.

During normal operation: All cross bar handle valves have odd numbers and must be OPEN.

All round handle valves have even numbers and must be closed.

WARNING: DO NOT START THE STEAM GENERATOR UNLESS THE COILS ARE FILLED WITH WATER. This is controlled by an isolating switch marked FILL, OFF and RUN, and this isolating switch must always remain in the FILL position until the coils are filled before switching to RUN. To move Control Switch—102 to RUN, first depress the spring loaded safety catch.

TO PREPARE AND FILL THE STEAM GENERATOR

Preparation

1. Check that the fuel and water supplies are adequate.
2. In frosty weather OPEN the round handle valve located on the R.H. side No. 2 end underneath locomotive body immediately above the No. 2 bogie and adjacent to the steam generator acid washing out connection, to supply steam to the heating coil in the water tank.
3. Open fuel supply valve in No. 2 cab.
4. Check that the air supply isolating cock is open (adjacent to bulkhead).
5. Check that the fuel oil return valve is open (handle being removed as locomotives pass through the workshops for repair).
6. Check that the water feed valve adjacent to the large water strainer is OPEN.
7. Check that the main boiler fuel supply valve in the engine room on the bottom of the engine fuel header tank is open.
8. Open atomising air shut off valve—1.
9. Close the main steam generator switch i.e. handle up.

10. In frosty weather on the right hand side of the steam generator at floor plate level there are two round handle valves side by side. Open the valve nearest to the main gangway one complete turn ONLY to supply steam to the heating coil below the steam generator water pump.

11. Check that the flue stack switch reset buttons are down, the hot contacts are closed and the cold contacts are open. Check overload and steam temperature reset button.

12. Check that the main steam valve—15 is closed.

13. Latch open the separator blow down valve—12.

14. Turn the handle on the fuel oil suction strainer at least three times.

15. Check that all the round handle valves are closed except No. 4.

TO FILL STEAM GENERATOR

1. Open the Fill test valve (4).

2. Close the separator blowdown valve (12).

3. Place boiler main switch to ON.

4. Turn Control Switch to FILL and check that:-
   (a) Motor runs.
   (b) Servo camplate turns clockwise.
   (c) When TEST button is pressed the motor STOPS.
   (d) When TEST button is released the motor runs.

   NOTE: If the motor fails to stop when the TEST button is pressed DO NOT put the generator into service as flame failure protection is inoperative.

5. Check ignition spark, through sight glass.

6. When water flows freely from fill test valve (4) turn switch to OFF and close valve. Visually check that the flap lifts in water flow sight glass (at floor level adjacent to Belt Guard).

TO START THE STEAM GENERATOR

NOTE: On no account should any attempt be made to start the generator UNLESS THE COILS ARE FILLED.

1. Latch open separator blowdown valve (12).

2. Turn control switch to RUN.

3. Check that the flame is established, then on:-
   (i) **Generators fitted with soot blower**
   (a) When steam pressure reaches 20 p.s.i. close separator blowdown valve (12) and check main steam valve (15) is closed.
   (b) Obtain working pressure (55-60 p.s.i.), adjusting water bypass regulator if necessary.

(c) Open soot blower valve (26) and leave open for 15-20 seconds then POSITIVELY CLOSE the valve.

(d) SLOWLY open the main steam valve (15). Press steam "ON" button (where fitted) when coupled to train.

(ii) **Generators not fitted with soot blower**

(a) When steam pressure reaches 40 p.s.i. close separator blow-down valve (12).

(b) SLOWLY open the main steam valve (15).

4. On adjustable types set the water by-pass valve to give the required pressure.
5. Open the separator blowdown valve several times for periods of from 3 to 5 seconds during the first few minutes of operation to clear excess water. When generator settles down, check that the return water flow indicator operates from 4 to 12 times each minute.

NOTE: It is very important that the main steam valve (15) is opened SLOWLY, otherwise the sudden expansion of steam leaving the generator may cause the steam temperature limit switch to operate.

TO STOP THE STEAM GENERATOR

1. Turn the control switch to OFF.
2. When steam pressure has fallen to 20 p.s.i. latch open separator blowdown valve (12).
3. Close main steam valve (15) SLOWLY. Press Steam "OFF" button (where fitted).
4. Open fill test valve (4), when steam pressure drops to ZERO.
5. Turn the control switch to FILL and allow motor to run for 10 minutes to cool coils.
6. Close separator blowdown valve (12).
7. When water flows from test valve (4) turn the control switch to OFF.
8. Close test valve (4).
9. Close the air atomising cock (1).
10. Place boiler main switch to OFF.
11. Close fuel oil supply cocks.

NOTES: It is of the utmost importance that the CORRECT shut down procedure is IMMEDIATELY carried out when the generator is stopped. Failure to do so will cause burning and scaling of the generator coils and damage to the flexible steam heating hose.

On modified generators the steam temperature limit switch settings have been reduced. Because of this, it is possible that initially on opening the main steam valve (15), the servo-regulator may temporarily move to the low fire position, hence the necessity of observing the instruction to SLOWLY open the steam valve.

All Stone generators will in future have their safety valves regulated to 65 p.s.i.

The maximum steam pressure as indicated on the steam gauge in the cab **nearest** to the train must not exceed 55 p.s.i.

FUSES FITTED

One 60 amp. main steam generator fuse marked F.16 in electrical equipment panel.

Four 15 amp. plus one spare fuse inside the steam generator control panel.

MISCELLANEOUS INSTRUCTIONS

If the steam generator fails to fire check the fuses. If fuses are correct close the water bye-pass regulator shut off valve—19. Set and manually regulate the train pipe steam pressure by partially opening valve—8 to keep the steam generator operating until repairs can be carried out.

The water flow sight glass fitted is connected to valve—4 for checking that the steam generator coils are full of water.

A number of locomotives are fitted in the cab with remote control buttons to operate the main steam valve—15. Whenever the cab STEAM ON or STEAM OFF buttons are operated the main steam valve—15 is operated by an electric motor which is mounted above the steam valve. If at any time it is necessary to operate the main steam valve—15 by hand where this equipment is fitted it is necessary to remove the centre driving bolt which engages with fork end lever immediately above the hand wheel on the main steam valve—15, or rotate the small lever on the side of the electric motor half a turn to disconnect the drive.

operating manual

British Railways locomotives D 5176 - D 5299 D 7500 - D 7677

AEI

SULZER

operating manual

British Railways locomotives D 5176 - D 5299 D 7500 - D 7677

Associated Electrical Industries Ltd.,
Industrial Group, Traction Division,
Trafford Park, Manchester 17

Sulzer Bros. (London) Ltd.,
Bainbridge House,
Bainbridge Street,
London, W.C.1.

CONTENTS

6 General Description

8 General Arrangement and Layout
10 Leading Particulars
12 Power Generation
13 Control of Power

14 Diesel Engine

15 General
16 Engine Instruments and Local Controls
17 Overspeed Trip
18 Fuel System
22 Lubricating Oil System
26 Cooling System
30 Load Control System

32 Electrical Equipment

33 Electrical Machines
34 Control Cubicle
40 Battery
40 Lighting
40 Shore Supply

42 Air System

42 General
42 Brake Systems

46 Driving Compartment

48 Driver's Desk
50 Second Man's Position

52 Steam Generator

54 General Description

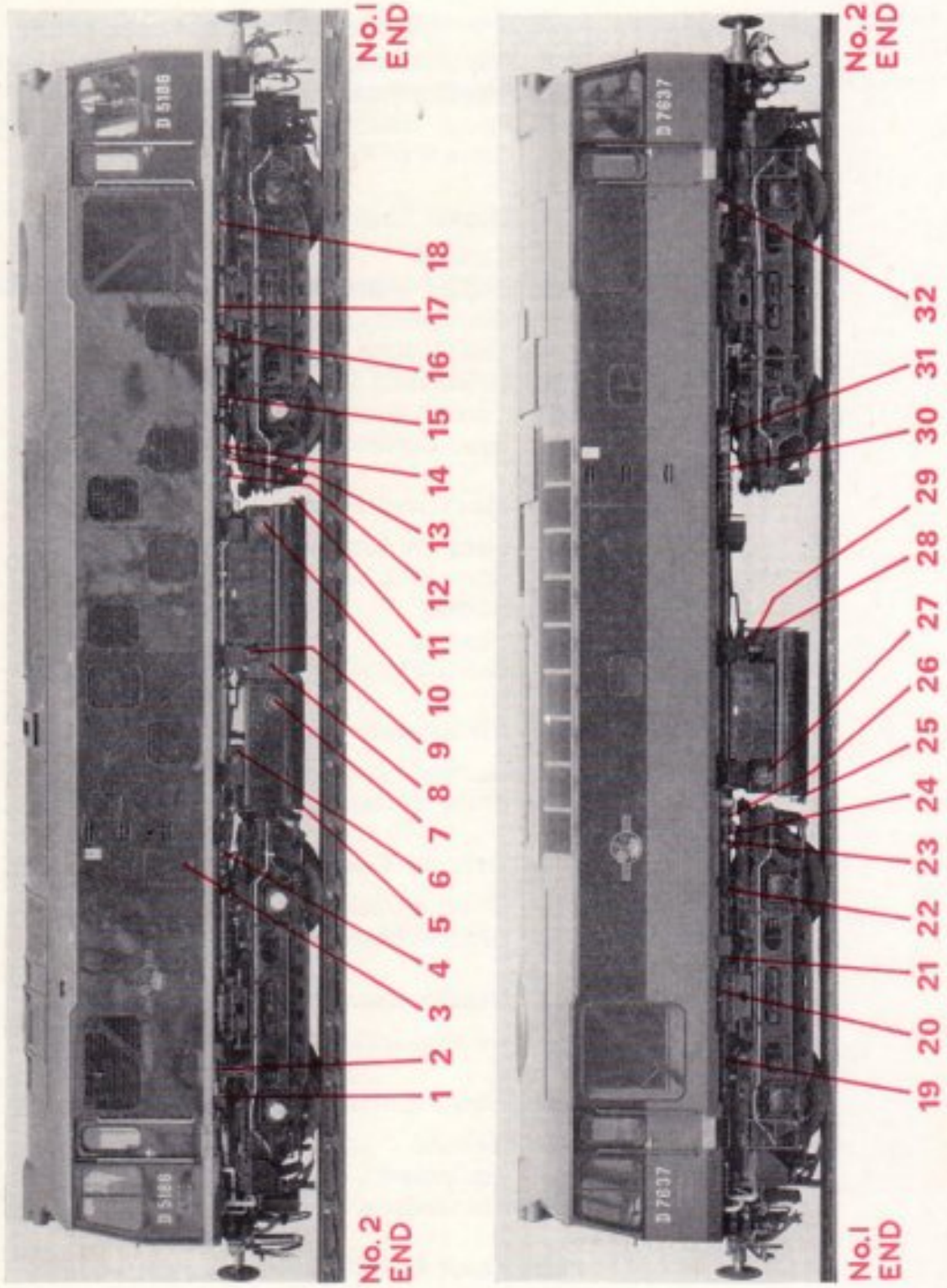
56 Fire Fighting Equipment

57 General
57 Equipment
57 Precautions

59 Fault Finding

60 Locomotive
82 Steam Generator

GENERAL DESCRIPTION



1. Fire extinguisher handle.
2. Steam generator
   —water pump test outlet
   —coil and separator blowdown
   —washout solution inlet.
3. Battery isolating switch and shore supply panel compartment.
4. Inspection light socket.
5. Steam generator water tank drain.
6. Steam generator water tank filler.
7. Steam generator water tank gauge.
8. Sealing plate drain.
9. Lubricating oil sump drain.
10. Fuel tank gauge.
11. Fuel tank drain.
12. Refuelling connection.
13. Lubricating oil pressure filling connection.
14. Inspection light socket.
15. Coolant filling connection and drain for engine and auxiliary tank.
16. Coolant test cock outlet.
17. Coolant test cock.
18. Coolant main tank and pump drain.
19. Coolant main tank and pump drain.
20. Coolant test cock.
21. Coolant test cock outlet.
22. Coolant filling connection and drain for engine and auxiliary tank.
23. Inspection light socket.
24. Lubricating oil pressure filling connection.
25. Fuel tank drain.
26. Refuelling connection.
27. Fuel tank gauge.
28. Sealing plate drain.
29. Lubricating oil sump drain.
30. Compressor and main reservoir drain.
31. Sockets panel—inspection light.
    —battery charging.
    —shed lighting.
32. Fire extinguisher handle.

Fig. 1 Exterior views of locomotive: above as D5176-5232, D7568-7597 with boiler water tank, below as D5233-5298, D7500-7567, D7598-7677 without boiler water tank.

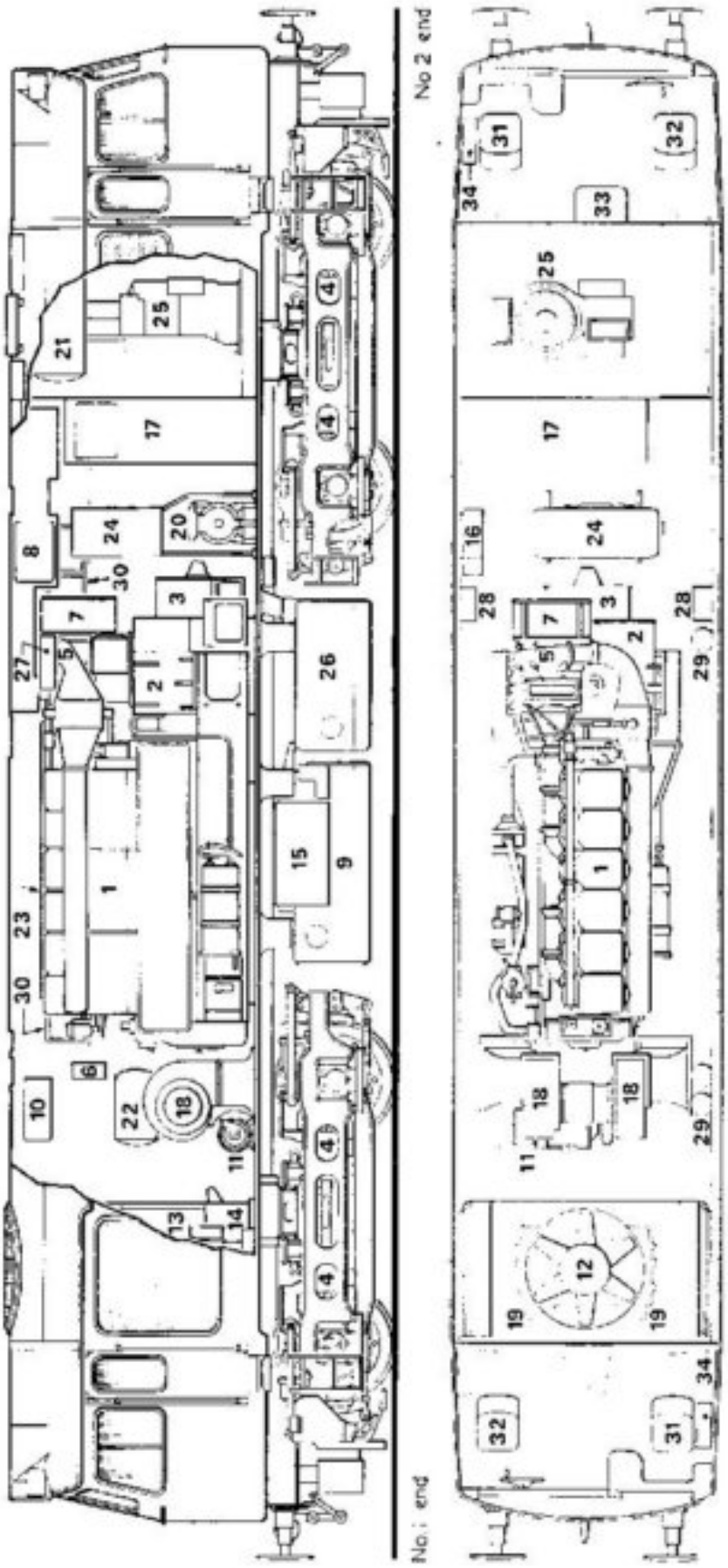
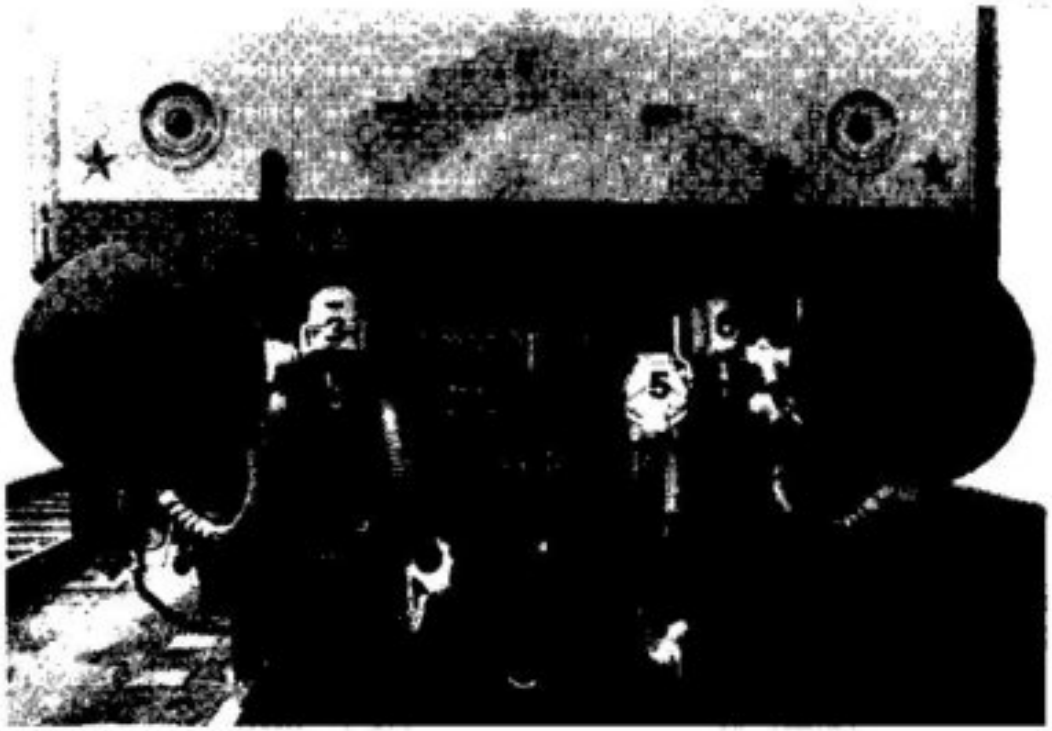


Fig. 2 General arrangement of the locomotive.
(Key below.)

1. Diesel engine.
2. Main generator.
3. Auxiliary generator.
4. Traction motors.
5. Pressure charger.
6. Engine instrument panel.
7. Engine air filter.
8. Silencer.
9. Main fuel tank.
10. Fuel and coolant header tank.
11. Combined pump set.
12. Radiator fan.
13. Radiator panels.
14. Radiator drain tanks.
15. Battery box.
16. Battery isolating switch.
17. Control cubicle.
18. Traction motor blowers.
19. Exhausters.
20. Air compressor.
21. Main air reservoir.
22. Control air reservoir.
23. Auxiliary air reservoir.
24. Brake gear cubicle.
25. Steam generator.
26. Steam generator water tank.
27. Steam generator water treatment tank.
28. Steam generator water filling duct.
29. Fire extinguishers.
30. Air filter panels.
31. Driver's position.
32. Second man's position.
33. Cooker.
34. A.W.S. switch unit.



1. Main reservoir pipe.
2. Engine control pipe.
3. Control jumper socket.
4. Vacuum pipe.
5. C.W. steam pipe.
6. Control jumper cable.
7. Engine control pipe.
8. Main reservoir pipe.

Fig. 3 Buffer beam connections.

GENERAL DESCRIPTION

LEADING PARTICULARS: D5176-D5299, D7500-D7677

Manufacturers	
Locomotive Builder	British Railways, Derby & Darlington Beyer Peacock Ltd., Gorton
Power Equipment	A.E.I. Ltd., (Traction Division) Sulzer Bros. (London) Ltd.
Locomotive Dimensions	
Wheel arrangement	B–B
Length over buffers	50'–6"
Width over body	8'–11 5/8"
Height	12'–8"
Total Wheelbase	36'–6"
Bogie Wheelbase	8'–6"
Bogie pivot centres	28'–0"
Weights in working order	
D5176–D5178, D5183–D5232, and D7568–D7597	73 ton 15 cwt.
D5179–D5182	71 ton 9 cwt.
D5233–D5237	73 ton 1 cwt.
D5238–D5299, D7500–D7567, and D7598–D7677	70 ton 14 cwt.
Max. axle loads	
D5176–D5178, D5183–D5232, and D7568–D7597	18 ton 17 cwt.
D5179–D5182	18 ton 5 cwt.
D5233–D5237	18 ton 12 cwt.
D5238–D5299, D7500–D7567, and D7598–D7677	18 ton 1 cwt.
Capacities	
Fuel—engine and boiler	510 gallons
Lubricating oil	100 gallons
Coolant	186 gallons
Boiler water	
D5176–D5178, D5183–D5237, and D7568–D7597	580 gallons
Diesel Engine	
Type	Sulzer 6LDA28–B
Continuous Rating	1,250 b.h.p. at 750 r.p.m.
Bore	280 mm. (11·02 in.)
Stroke	360 mm. (14·16 in.)
Main Generator	
Type	A.E.I. RTB 15656
Continuous Rating	780 volts at 1050 amps
1 hour Rating	545 volts at 1500 amps
Maximum current	2640 amps

Auxiliary Generator	
Type	A.E.I. RTB 7440
Continuous Rating	
D5176–D5299, D7500–D7597	50 k.w.
D7598–D7677	54 k.w.
Traction Motors	
Type	A.E.I. 253 AY
Continuous Rating	650 amps at 315 volts
Gear Ratio	67 :18
Steam Heating Generator	
D5176–D5178, D5183–D5237, and D7568–D7597 only	
Type	Stone Vapor L4610
Rating	1150 lb./hr.
Locomotive Performance	
Maximum Tractive Effort	46,500 lb.
Continuous Tractive Effort	20,500 lb. at 18 m.p.h.
Maximum Speed	90 m.p.h.
Minimum curve negotiable	4½ chains

GENERAL DESCRIPTION

POWER GENERATION

The power for the operation of the locomotive is developed by a Sulzer six-cylinder diesel engine, driving an A.E.I. generator group. This comprises Main and Auxiliary generators. f.4

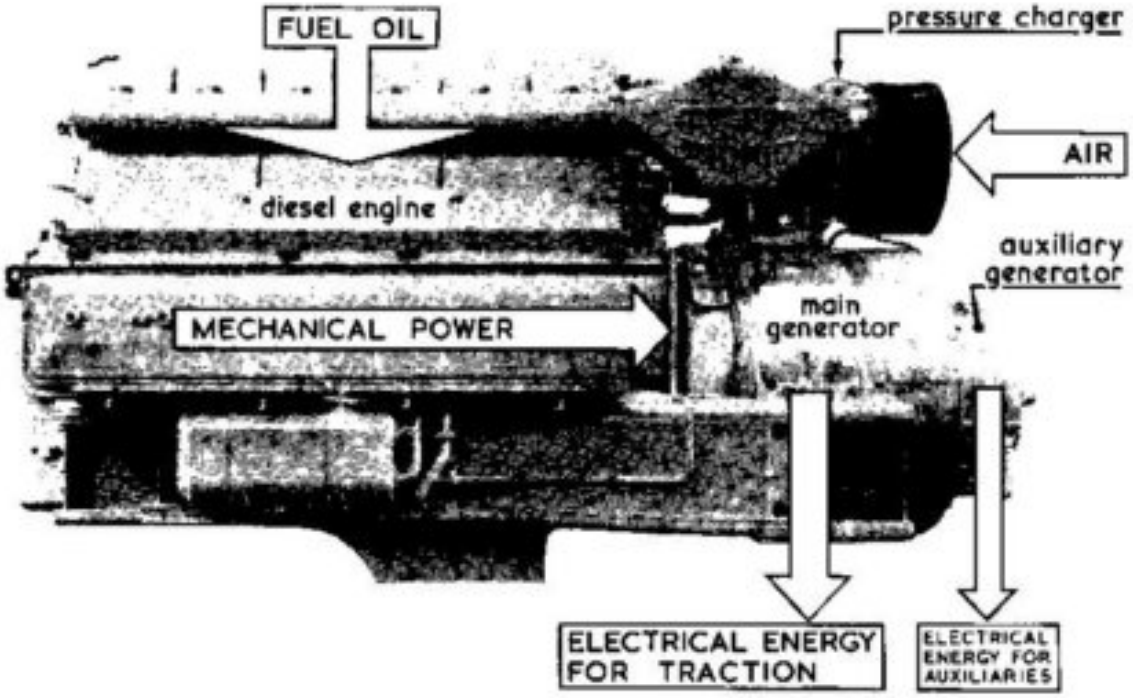


Fig. 4 Power generation.

Power Distribution

The main generator converts the engine power to high voltage direct current which is supplied to the four traction motors through the control cubicle. f.5

The traction motors, which are geared to the driving axles, convert the electrical energy to mechanical energy for traction.

The auxiliary generator converts up to 54 k.w. into electrical energy at a low voltage of 110 volts direct current which is distributed through the control cubicle to operate the auxiliary motors, charge the starting battery, excite the main generator and provide current for heaters, lights, cookers, control gear and steam generator.

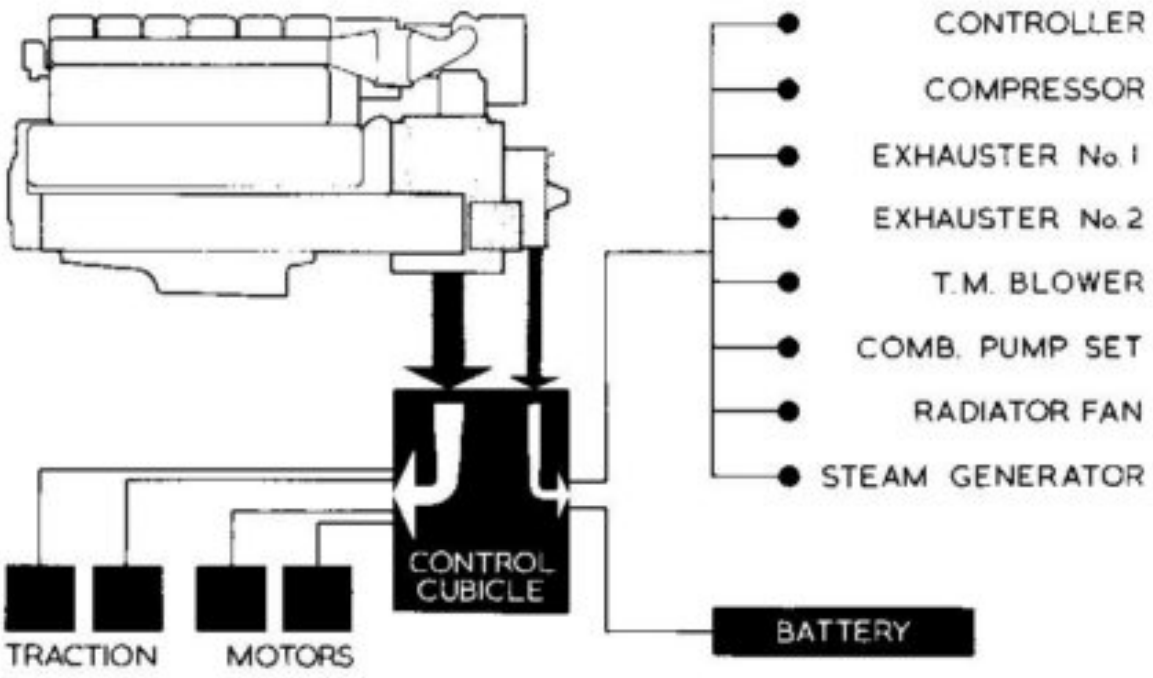
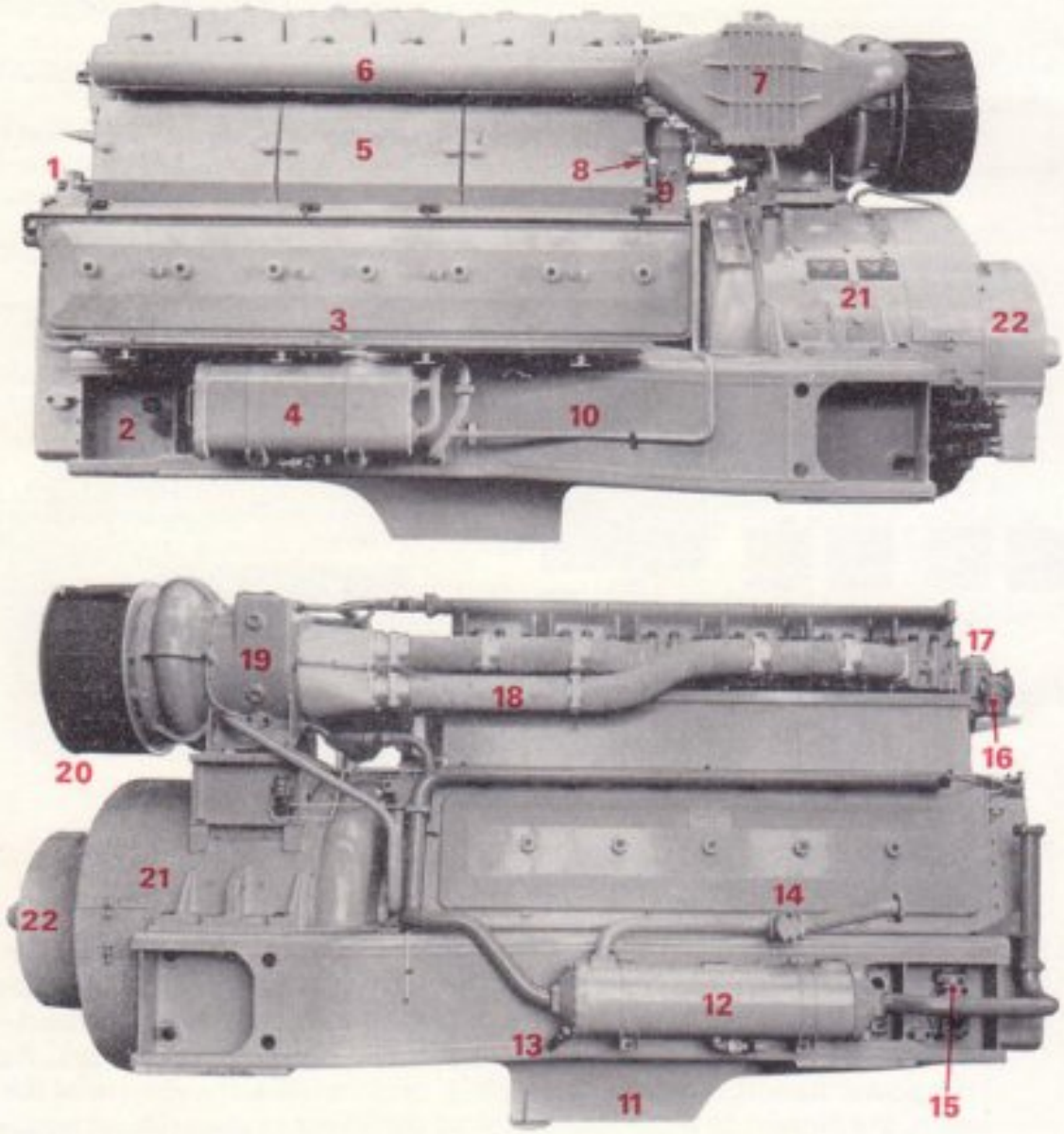


Fig. 5 Power distribution.

CONTROL OF POWER

f.27 f.28 On moving the power handle from the 'Off' to the 'On' position, with the reverser handle in 'Forward' or 'Reverse' positions, the main generator is connected to the traction motors. Sufficient power is obtainable in the 'On' position to move a light locomotive on level track. As the power handle is moved to notch '$\frac{1}{4}$' prior to initial movement of the train, the current to the traction motors increases to give almost maximum tractive effort at the wheels. Further movement increases engine power, until the power handle is moved into the 'Full' position giving maximum power for traction.



1. Overspeed trip.
2. Lubricating oil filler.
3. Dipstick.
4. Lubricating oil filter.
5. Fuel pump gallery.
6. Air inlet manifold.
7. Charge air intercooler.
8. Engine stop lever.
9. Governor.
10. Crankcase.
11. Sump.
12. Heat exchanger.
13. Engine coolant drain cock.
14. Heat exchanger lubricating oil by-pass valve.
15. Lubricating oil filter by-pass valve.
16. Fuel strainer.
17. Fuel filter.
18. Exhaust manifold.
19. Pressure charger.
20. Engine air filter.
21. Main generator.
22. Auxiliary generator.

Fig. 6 Elevations of engine generator set.

GENERAL

f.6 The Sulzer diesel engine is of the four stroke, pressure charged, vertical type, and has direct injection. The pressure charged air is cooled in an intercooler before entering the cylinders. The six cylinders are arranged in line and numbered 1 to 6 from the free end.

The diesel engine operating cycle consists of 4 piston strokes as follows :—

1. Introduction of fresh air (charging air) into the cylinder under pressure from the pressure charger. It passes through the intercooler before entering the inlet manifold.
2. Compression of the air, followed by injection and atomisation of the fuel.
3. Combustion of the Fuel/Air mixture and expansion of the generated gasses. This is the working stroke.
4. Expulsion of the exhaust gases and scavenging with fresh air.

The speed of the engine may vary between 325 and 750 r.p.m. and is
p.30 controlled by the governor in response to the driver's power handle. At full load the charge air pressure is approximately 14lb/sq.in.

ENGINE INSTRUMENTS AND LOCAL CONTROLS

The engine instrument panel is located at the free end of the engine and contains the following instruments :— 2.6 f.7

1. **Water pressure gauge** indicating the engine coolant pressure.
2. **Water temperature gauge** indicating the engine coolant temperature.
3. **Engine speed gauge** (Tachometer) indicating the engine r.p.m.
4. **Oil temperature gauge** indicating engine lubricating oil temperature.
5. **Oil pressure gauge** indicating engine lubricating oil pressure.
6. **Regulating air gauge** indicating the pressure of the control air to the engine governor.
7. **Charging air gauge** indicating the pressure of the air supplied by the pressure charger to the cylinders.
8. **Exhaust temperature gauge** (pyrometer) indicating the exhaust temperature at any one of seven places, is a single instrument with a selector switch. Positions 1 to 6 are in the exhaust pipe adjacent to cylinder of that number and position 7 is between the pressure charger and the silencer.

The local controls comprise :—

9. **Engine start button** situated just below the instrument panel.

Emergency stop lever connected to the engine fuel control shaft adjacent to the governor. f.8

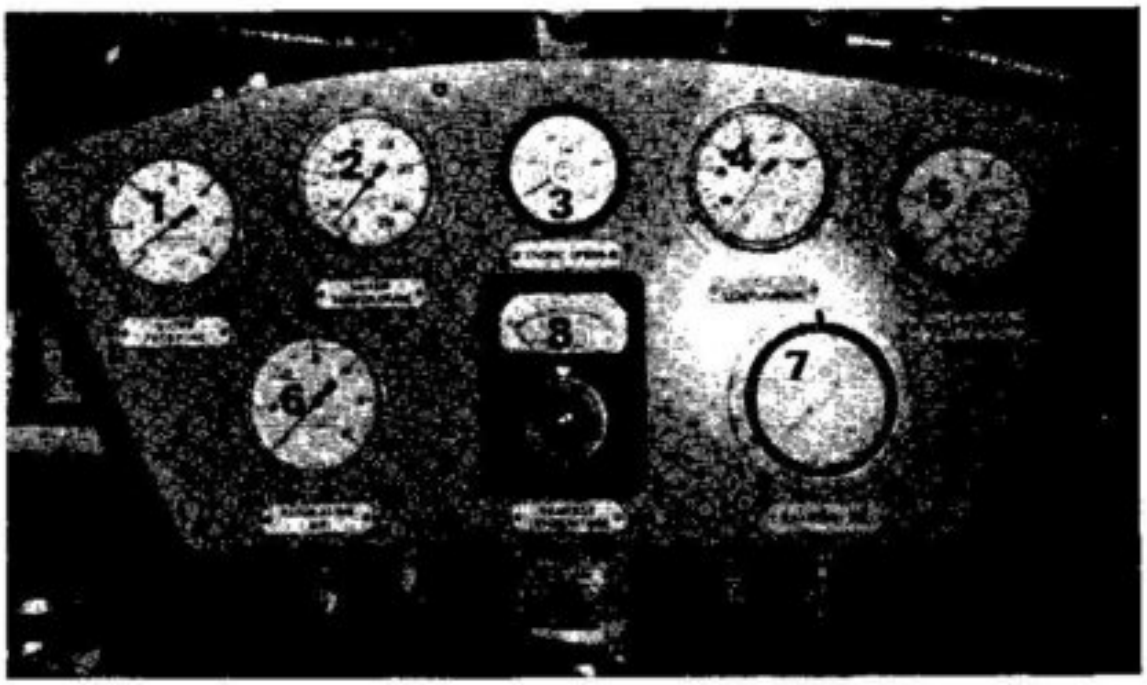


Fig. 7 Engine instrument panel.

Fig. 8 Engine stop lever.

Fig. 9 Resetting overspeed trip.

OVERSPEED TRIP

5 1 The overspeed trip will cause the engine to be stopped should it exceed about 890 r.p.m.

On many of the overspeed trip devices a hole will be found on the side of the body opposite to the lever which is connected to the fuel control rod. If a red surface can be seen in this hole, then the device has tripped. Otherwise a trip can be ascertained by feeling a collar bearing on the lever on the fuel control rod.

f 9 The overspeed trip is reset by placing the resetting lever on the control rod and placing the pin on the side of the lever under the collar inside the device. Bearing on the lever to lift the collar, until it is felt to click on the catch, resets the device.

DIESEL ENGINE

FUEL SYSTEM

List of equipment

1. **Main tank** holding 510 gallons.
2. **Strainer**
3. **Transfer pump** drawing fuel from the main tank and passing it under pressure (30 lb./sq. in. approx.) to the engine.
4. **Pressure feed cock** (normally open).
5. **Strainer**
6. **Fine filter,** protecting the injection equipment, is fitted with a replaceable paper element.
7. **Injection pumps,** delivering fuel under high pressure to the injectors, determine the quantity of fuel and time of injection. They are controlled by the engine governor, via the fuel pump control shaft. Individual injection pumps can be isolated.
8. **Injectors** atomising the fuel and spraying it into the cylinders.
9. **Relief valve** controlling the fuel supply pressure to the engine by allowing excess fuel to flow through the auxiliary tank back to the main tank.
10. **Auxiliary tank** holding a reserve supply of 10 gallons.
11. **Gravity feed cock** (normally closed).
12. **Fine filter by-pass cock** (normally closed).
13. **Cock** for the steam generator fuel supply.
14. **Fuel supply** to the steam generator.
15. **Excess fuel return** from the steam generator.
16. **Drain cock** for the auxiliary tank.
17. **Drain** to the locomotive sealing plate.
18. **Filling connections** with automatic shut off valves and filters, for filling the main tank from either side of the locomotive.
19. **Gauges** (one each side) indicating the fuel level in the main tank.
20. **Drain cocks** for the main tank.

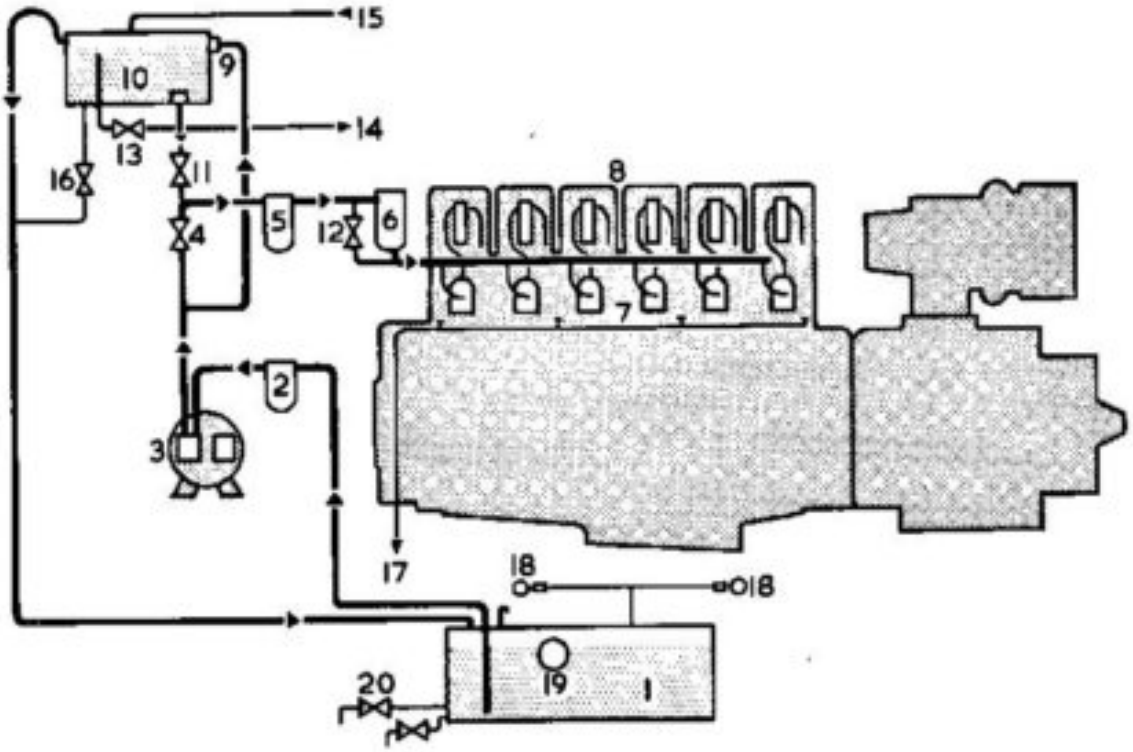


Fig. 10 Schematic diagram of fuel system.

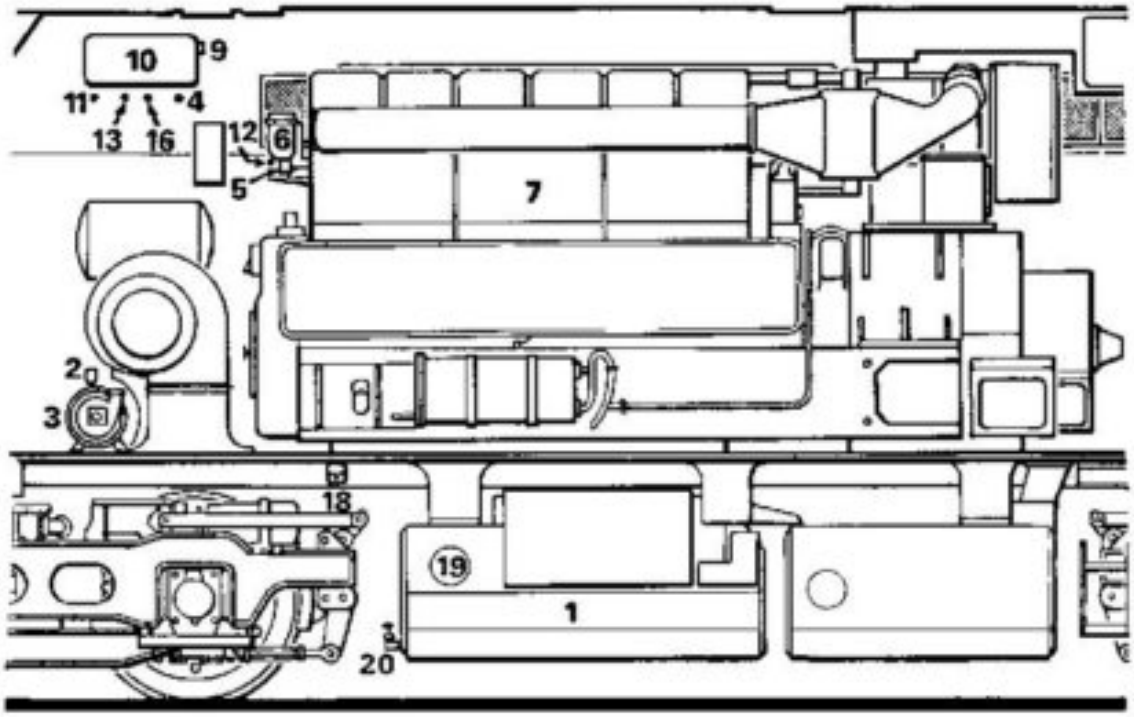


Fig. 11 Location of fuel system equipment.

Isolation of fuel pumps

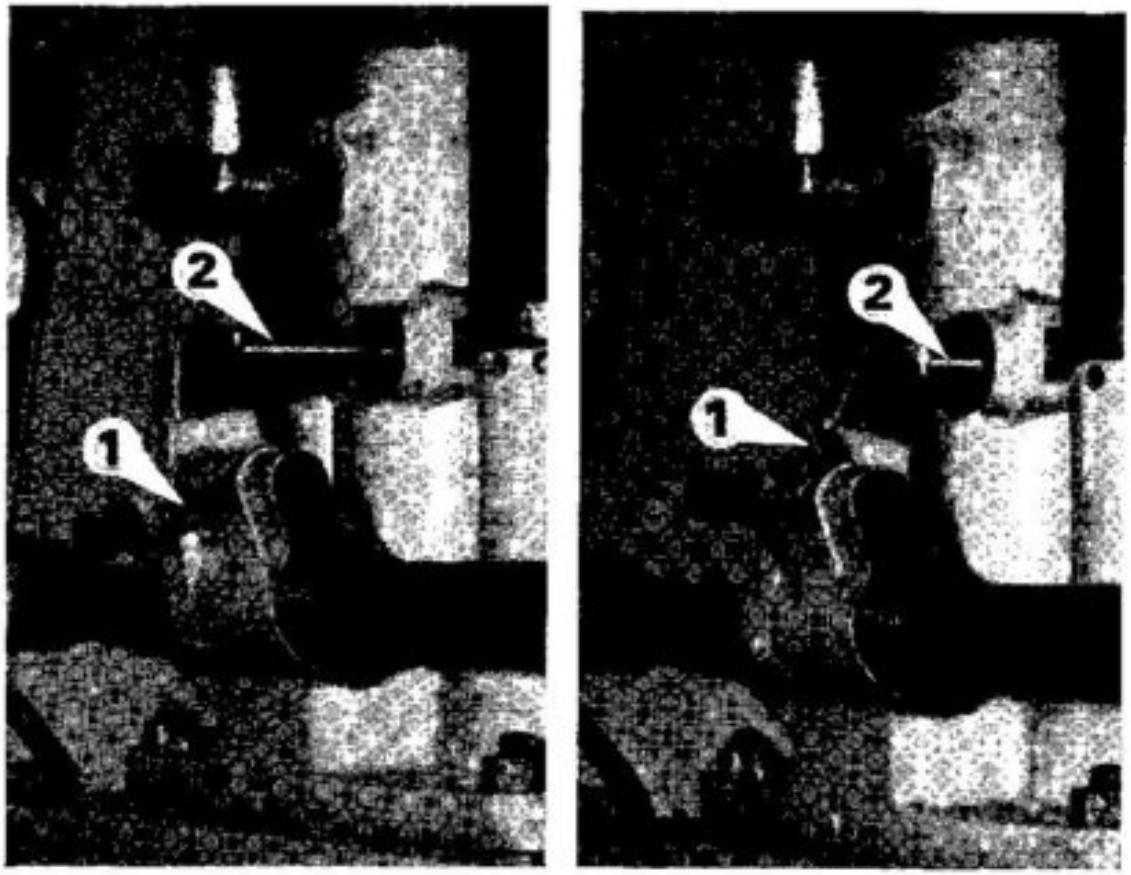
Should there be a defective injector pipe, the corresponding injection pump may be isolated. Only one injection pump may be isolated at any time. f.12

The procedure is as follows :—

(a) Remove the cover from the fuel pump gallery.
(b) Push the isolating lever to the right and lock it by pushing towards the engine. 12.1
(c) Push fuel pump control rack right in (towards engine). 12.2

To re-engage fuel pump (only by maintenance staff) :—

(a) Pull isolating lever forward.
(b) Gently pull out control rack on the pump until the lever springs into the normal running position. 12.1 12.2



NORMAL ISOLATED

Fig. 12 Isolation of fuel pump : 1. Isolating lever.
2. Control rack.

Gravity feed

f.10 f.11 Provision is made for a gravity feed supply to the engine from the auxiliary tank, but as this entails by-passing the fine filter, it must only be used in an emergency, when pressure feed is not possible.

To obtain gravity feed, the procedure is as follows :—

(a) Switch off steam generator. Note that if the steam generator is running when the pressure feed ceases, the fuel supply to it will automatically be cut off when the level in the auxiliary tank falls below the top of the standpipe through which it is supplied.

(b) Close the pressure feed cock (4).

(c) Open the gravity feed cock (11).

(d) Open the fine filter by-pass cock (12), using the special key from the driver's tool board in the cab locker. The key is retained in the cock to indicate that it has been used. This cock may also be opened if the fine filter becomes blocked. The use of this cock for any reason must be reported, and the fault rectified as soon as possible, as prolonged running with the cock open will result in excessive wear of the fuel injection equipment.

Under gravity feed conditions there is sufficient fuel to run about 10 miles.

DIESEL ENGINE

LUBRICATING OIL SYSTEM

List of equipment

1. **Oil Sump** containing the engine lubricating oil.
2. **Suction strainer**
3. **Pressure Pump** (engine driven) drawing the oil from the sump and circulating it through the system.
4. **Relief Valve** limiting the pressure in the system.
5. **Strainer**
6. **Heat Exchanger** in which the oil is cooled by the engine coolant. 6.12
7. **Heat Exchanger By-Pass Valve** allowing oil to by-pass the heat exchanger should it become blocked. 6.14
8. **Fine Filter** 6.4
9. **Filter By-Pass Valve** allowing oil to by-pass the filter should the pressure rise above a set level. 6.15
10. **Main Crankshaft Bearings,** from which the oil is passed through the connecting rods to the small ends and pistons.
11. **Camshaft Bearings**
12. **Pressure Charger**
13. **Valve Rockers,** from which the oil drains down the push rods lubricating the tappets and cam rollers before returning to the sump.
14. **Priming Pump** (motor driven) enabling oil to be pumped through the system before the engine is started, and after it has stopped.
15. **Governor** using lubricating oil pressure to operate its servo system.
16. **Pressure Gauge** 7.5
17. **Pressure Switch** stopping the engine should the pressure fall below 12 lb./sq. in.
18. **Thermometer** indicating the temperature of the oil leaving the heat exchanger. 7.4
19. **Hand filling point** 6.2
20. **Pressure filling connections** 1.13, 1.24
21. **Dipstick** indicating the oil level in the engine sump. 6.3
22. **Cock** for taking oil samples.
23. **Sump Drain Cock** allowing the sump to be emptied.
24. **Self-sealing draining connections** 1.9, 1.29
25. **Coolant by-pass valve.** This may be either the Sulzer lubricating oil operated type, or the Amot type which is not connected to the lubricating oil system. f.18

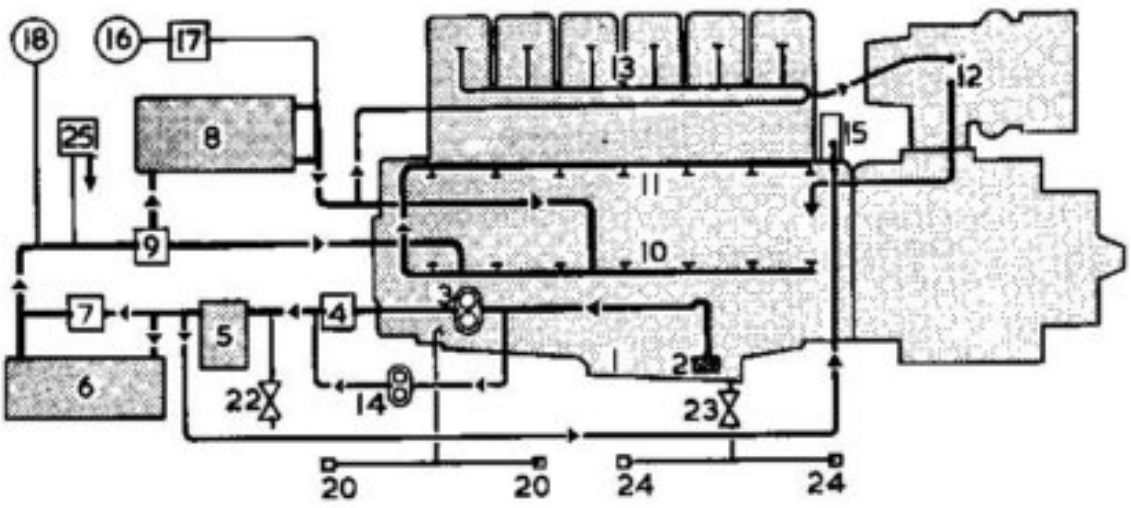


Fig. 13 Schematic diagram of lubricating oil system.

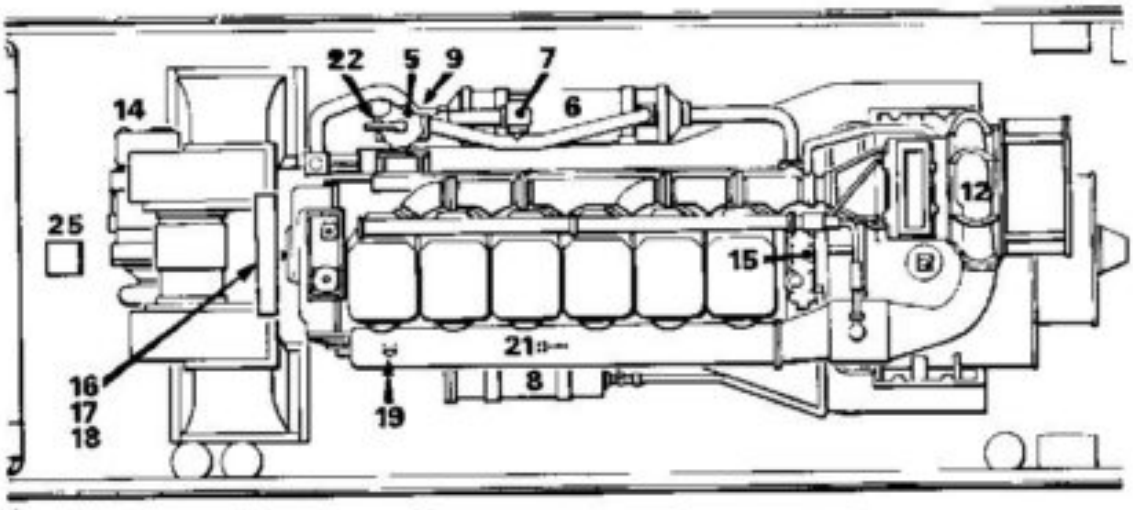


Fig. 14 Location of lubricating oil system equipment.

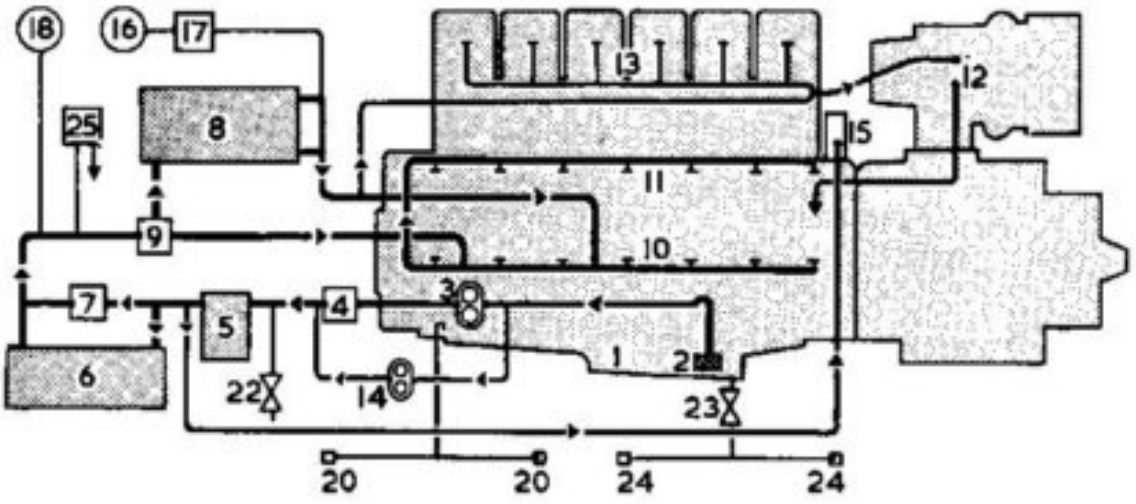


Fig. 13 Schematic diagram of lubricating oil system.

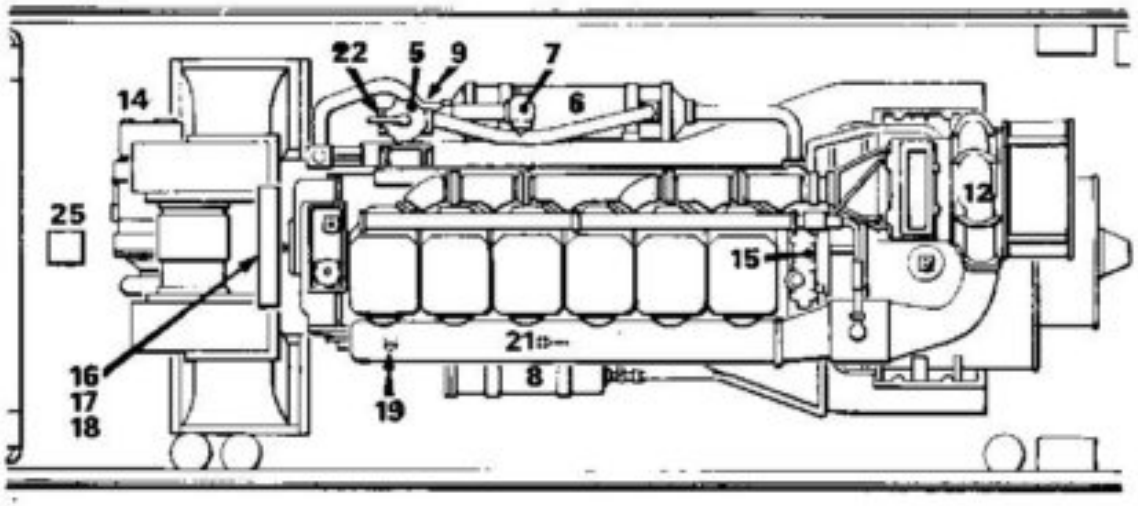


Fig. 14 Location of lubricating oil system equipment.

Checking the Oil Level

Normal checking of the oil level is carried out by Maintenance staff. Readings of the dipstick should be taken after the engine has stopped. On locomotives up to D7597 this should be done about 2 minutes after the engine has shut down, with the pump set still running. On D7598 and later locomotives the pump set will automatically stop 2 minutes after the engine has shut down and the reading should be taken immediately this happens. If it is necessary to check the level when the engine has not been running, the pump set must be run for 2 minutes prior to taking a reading. Ensure the locomotive is standing on level track and wipe the dipstick before taking a reading.

The level should be between 'Min.' and 'Max.' marks which are intended as a working range. If the level is appreciably below the 'Max.' mark, top up the sump. f.15

Do not top up to the 'X' mark. This is only for initial filling after overhaul when the system is completely empty.

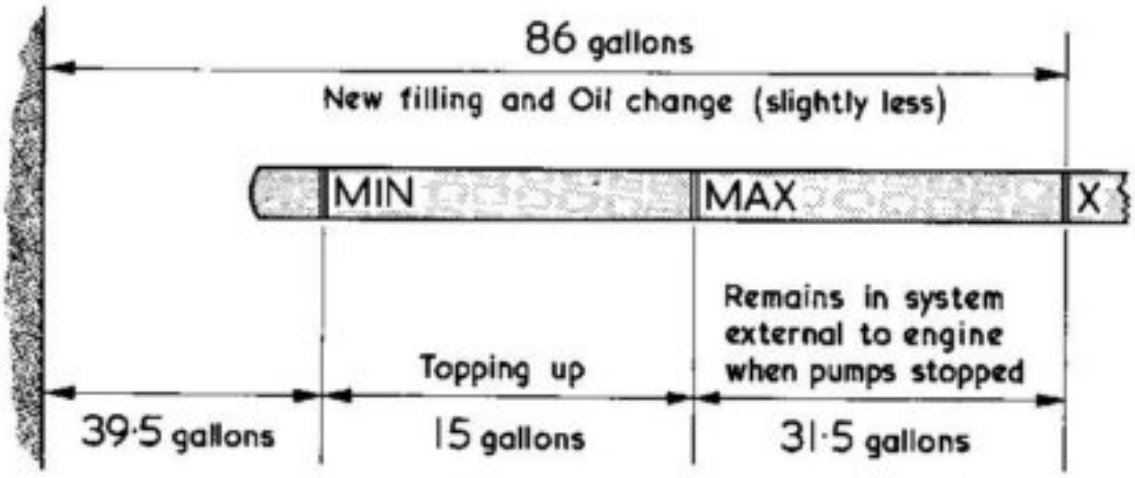


Fig. 15 Dipstick markings related to capacities.

Oil Pressure

7.5 The gauge should read about 20–30 lb./sq. in. when idling, and about 50 lb./sq. in. on full load.

If the pressure falls appreciably below this figure:

6.3 (a) Check level of oil in the sump by dipstick.

14.5 (b) Turn handle of lubricating oil strainer.

If oil level is satisfactory, report the low oil pressure condition as soon as possible. The engine is automatically stopped by the pressure switch should the oil pressure drop below 12 lb./sq. in.

Oil Temperature

7.4 This should normally be below 175°F. The engine must not run with an oil temperature above 200°F.

COOLING SYSTEM

List of equipment

1. **Pump** circulating coolant through the system.
2. **Heat exchanger,** in which the lubricating oil is cooled. 6.12
3. **Engine cooling passages**
4. **Pressure charger**
5. **Intercooler** in which the charge air to the engine cylinders is cooled. 6.7
6. **Auxiliary tank,** ensuring an even flow of coolant in the system, has mounted inside it three temperature switches. Two control the radiator fan and the third initiates a 'fault' warning should the coolant temperature exceed 185°F.
7. **Thermostatic by-pass valve** diverting the coolant flow from the radiators when it is cold, so as to produce rapid warming up. f.18 f.19
8. **Radiator panels,** in which the coolant loses heat to the atmosphere.
9. **Fan,** drawing air through the radiator panels, is started when the coolant temperature reaches 168°F, and speeds up if the temperature exceeds 175°F. High fan speed cannot be obtained if the locomotive is on less than $\frac{3}{8}$ of full power.
10. **Main tanks** under the radiators, enabling the panels to drain automatically when circulation ceases or the coolant by-passes the radiators, thus preventing water freezing in the panels during frosty weather.
11. **Sight level glasses,** showing the amount of coolant in the main tanks, should indicate at least $\frac{3}{4}$-full when the pump is stopped. f.20
12. **Pressure switch** stopping the engine should the coolant circulation fail.
13. **Pressure gauge** 7.1
14. **Thermometer** indicating the temperature of the coolant leaving the engine. 7.2
15. **Cocks** which are opened for filling the system and draining the engine and auxiliary tank.
16. **Connections** on each side of the locomotive used for filling and draining in conjunction with cocks (15). 1.15 1.22
17. **Drain Cocks** which are opened to empty main tanks and pump. 1.18
18. **Test cocks** which are opened when filling the system, to indicate, when coolant flows out of them, that the correct coolant level in the main tanks has been reached. 1.17 1.20 1.16, 1.21
19. **Entry for water treatment**
20. **Cock** for sampling.

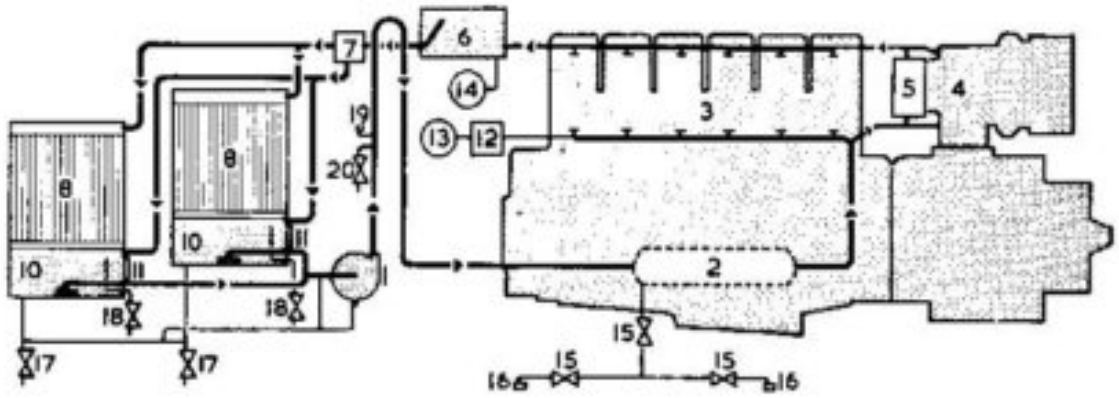


Fig. 16 Schematic diagram of coolant circuit.

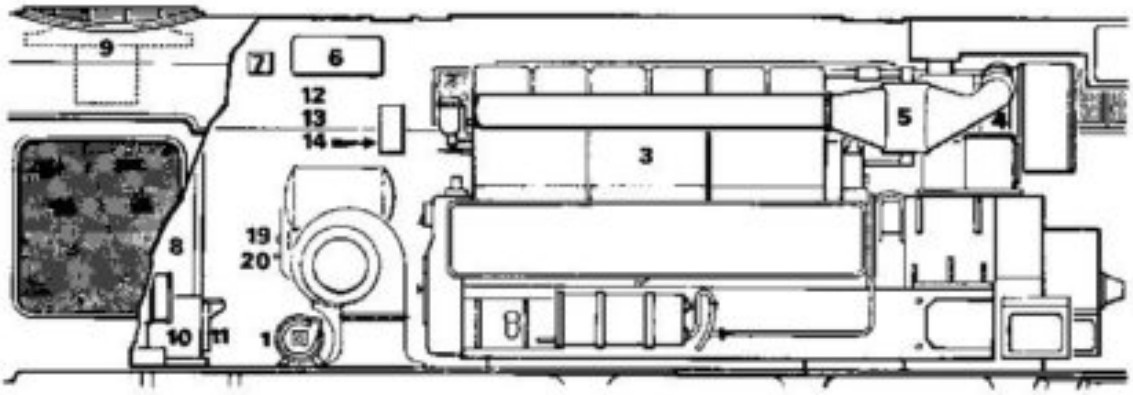


Fig. 17 Location of cooling system equipment.

Coolant Pressure

7.1 This should be at least 10 lb./sq. in. when the pump is running with the engine stopped and about 15 lb./sq. in. when the engine is running.

The engine is stopped automatically should the pressure drop below 4 lb./sq. in.

Coolant Temperature

7.2 28.17 22.8 The normal operating temperature should be between 165°F and 175°F as indicated on the thermometer. The 'Fault' lights on the driver's panels and the indicator relay in the control cubicle give warning if the temperature exceeds 185°F.

f.18 f.19 The Amot or Sulzer thermostatic by-pass valve automatically admits coolant through the radiators if the temperature exceeds 160°F. If

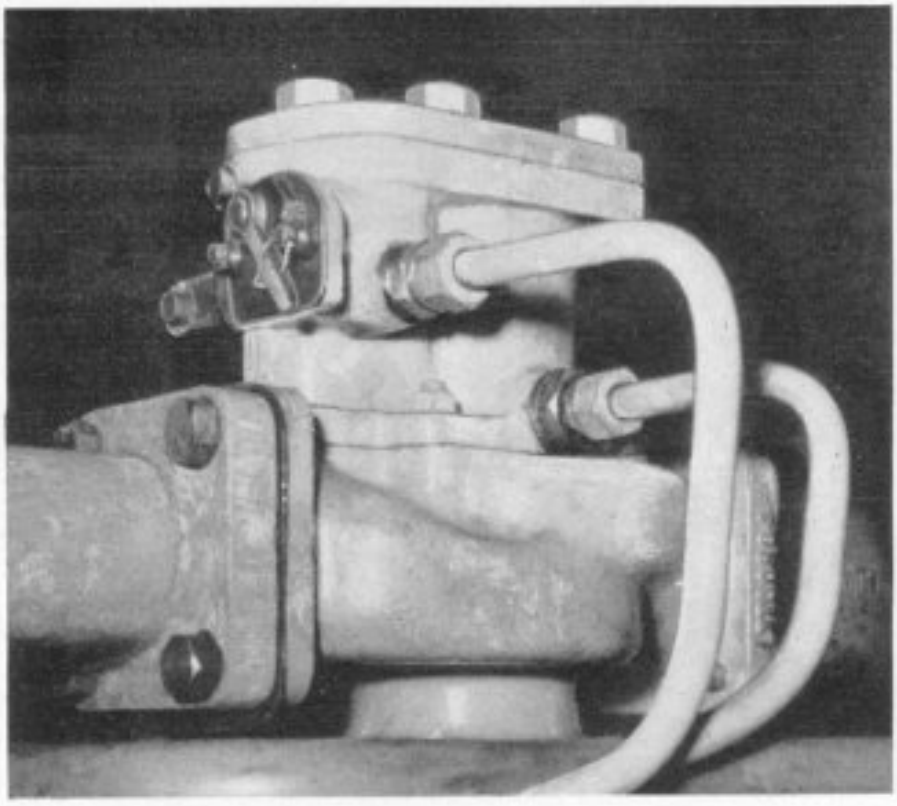


Fig. 18 Thermostatic by-pass valve—Sulzer type showing lever.

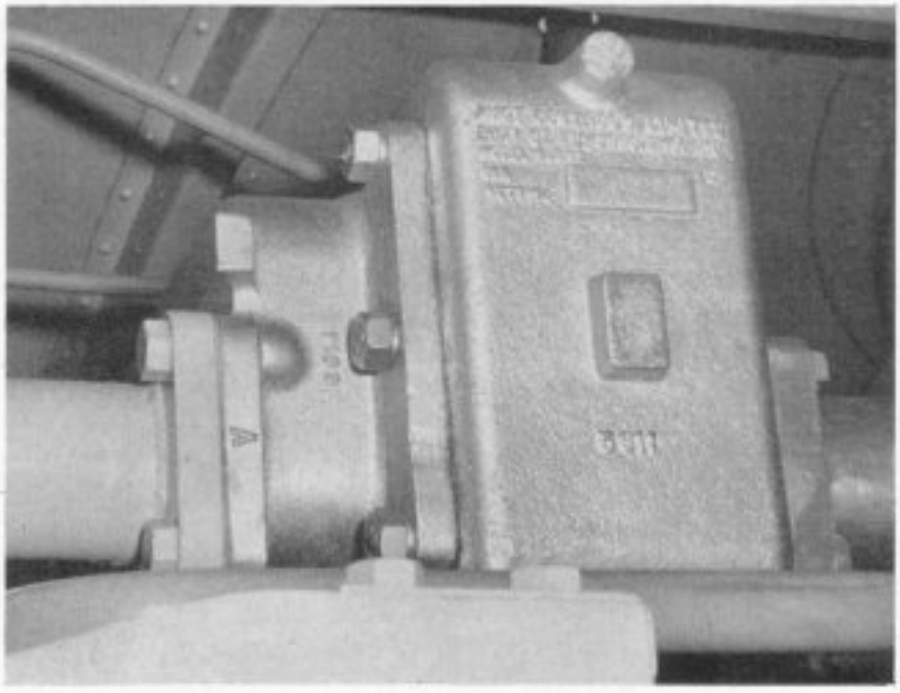


Fig. 19 Thermostatic by-pass valve—Amot type.

the temperature falls below 140°F the valve diverts the coolant direct to the main tanks, by-passing the radiators.

f.18 On the Sulzer thermostatic by-pass valve there is a lever which is normally sealed in the position marked 'automatic'. Only in special circumstances, which must be reported, may the seal be broken and the lever put to one of the other two positions, 'O' or 'direct'. These are :—

(a) If the thermostat is not operating correctly, the lever should be put to 'direct', which admits coolant through the radiators regardless of temperature.

(b) If one of the radiators develops a bad leak, the lever should be put to 'O', all the coolant then by-passing the radiators. Care must be taken, when running in this condition, that the coolant temperature does not exceed 185°F.

f.19 The Amot valve is entirely automatic, depending upon two temperature sensitive wax elements for its operation.

If the coolant temperature exceeds 185°F and it is suspected that
23.5 the fan control switches are defective, turn the 'Radiator fan switches' on the control cubicle to the 'hand' position.

Checking the Coolant Level

(a) Stop the engine and combined pump set, and wait for the coolant to settle in the main tanks.

f.20 (b) Check the sight level glass on each main tank.

(c) If the level is low proceed as for filling the system.

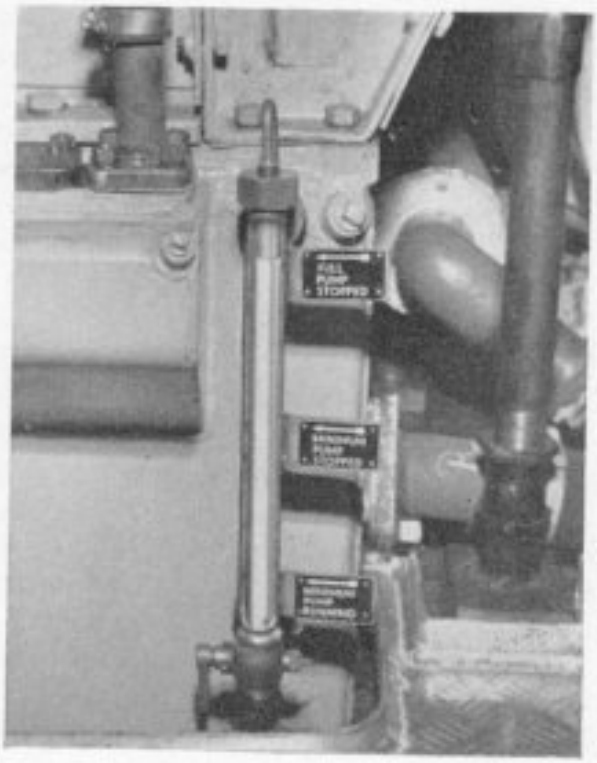


Fig. 20 Coolant sight level glass on main tank.

Filling the System

(a) With the engine and pump stopped, open one of the test cocks (18) on the end of the main tank. f.16
(b) Attach the hose to either of the connections (16) and open the cocks (15) by the appropriate connection and at the end of the heat exchanger.
(c) Fill the system until coolant runs out of the test cock pipe (18), which discharges outside the locomotive.
(d) Close cocks (15) and disconnect hose.
(e) Close test cock (18).

Do not add coolant unnecessarily or fill a hot engine with cold coolant. It is preferable to top up the system before the engine has been run. The water used in the diesel engine cooling system is treated with a special compound, to reduce deposits and resist corrosion, which is different from that used for steam locomotives. Therefore only the special coolant should be used.

Draining the System

To drain the engine and auxiliary tank, open cocks (15) at the Heat exchanger and on either side of the locomotive. To drain the main tanks and pump open cock (17) on either side of the locomotive. The engine should be allowed to cool down before draining. f.16

LOAD CONTROL SYSTEM

The load control system is the means by which the engine and generator output is matched to suit the demands of the locomotive. Since the characteristics of the traction motors, main generator and diesel engine are not the same, a unit is incorporated to co-ordinate the demands and outputs of these parts. The unit that does this is the Governor including the load Regulator.

The governor makes sure that the engine has the correct load to match the speed at which it is running. Each engine speed has a particular load to yield the best fuel consumption at that speed. Thus the

engine can be made to give the lowest possible fuel consumption throughout its speed range from 325 to 750 r.p.m. So for a particular engine speed the governor may cause the load regulator to increase or decrease the main generator field thereby loading or unloading the engine to the required value.

The load regulator also controls the traction motor field diverts except on D7598–D7677 which use an electronic track speed sensing system for this purpose. These diverts alter the traction motor fields in 6 stages (2 stages in D7598–D7677) and consequently the speed range at which the motors may operate. The speed range of a traction motor at a constant field strength is limited to about 20 or 30 m.p.h. at its highest efficiency. This means that a one value of field strength the motor may perhaps operate from 0 to 30 m.p.h. and altering the field a predetermined amount gives a speed range from 30 to 45 m.p.h. and so on. Therefore the motors may work throughout the locomotive speed range at their highest efficiency.

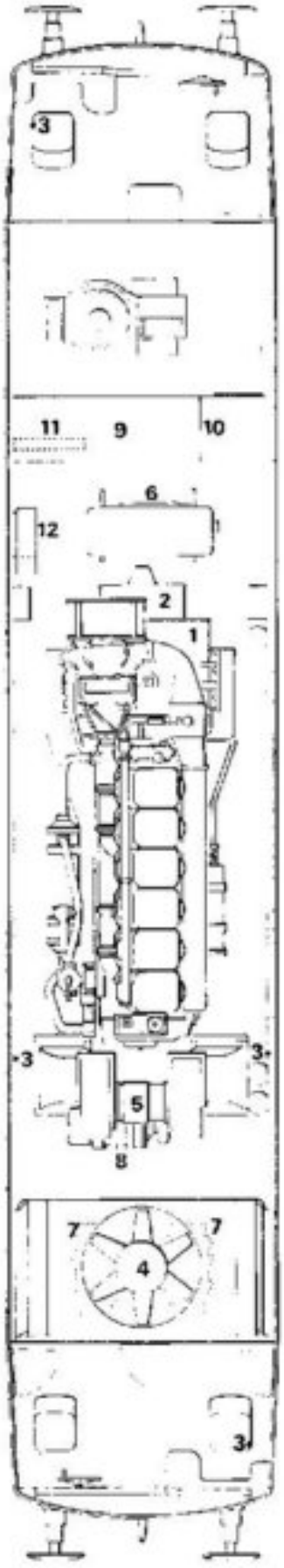
The governor also sets the engine speed according to the command from the drivers power handle. Of the three rigidly fixed relationships, speed, load, and horsepower, speed is the only one that the governor can sense. This it does by fly weights, driven by the engine camshaft. The governor then arranges a certain load for that speed, and maintains it should the locomotive run into a gradient without the power handle having been moved.

The command from the power handle is transmitted to the governor by varying the pressure of the regulating air. This varies from 5 lb./sq. in. at idling to 45 lb./sq. in. at full load.

There are protection devices both incorporated in the governor and situated on the engine. In the governor there is the electromagnetic engine run solenoid which must be energised for the engine to run. High temperature and low pressure switches are connected to this solenoid such that they de-energise it under abnormal conditions and cause the engine to be stopped. The governor also contains a device to limit the fuel injected at starting and acceleration since the pressure charger takes a little while to accelerate and deliver the necessary amount of air.

The engine contains an overspeed trip which will cause the engine to stop should the engine speed exceed the permissible maximum. An engine stop lever is provided on the engine which when pushed manually will stop the engine should it be required to do so.

A gauge indicating the pressure of the regulating air is amounted in the control compartment.



1. Main generator.
2. Auxiliary generator.
3. Inspection light sockets—those indicated in the cabs are roof mounted.
4. Fan motor.
5. Traction motor blowers motor.
6. Compressor.
7. Exhausters.
8. Combined pump set.
9. Control cubicle.
10. Switch, and fault indicator panels.
11. Fuse panel.
12. Battery isolating switch compartment.

Fig. 21 Location of electrical equipment.

ELECTRICAL MACHINES

21.1 **Main Generator** converting the engine power to high voltage direct current for traction.

21.2 **Auxiliary Generator** converting up to 54 k.w. into 110 volt direct current for operating the auxiliary motors, control gear, heaters and lights and charging the battery.

2.4 **Four Traction Motors** providing the power to the wheels, are grouped electrically into two circuits of two motors. Each motor has a system of resistances called 'Field Diverts' in its field circuit which extends the speed range at which the motor can operate. Stages of weaker field are introduced to enable higher locomotive speeds to be obtained.

The following are all powered by electric motors :—

21.5 **Two Traction Motor blowers,** driven by one motor, force air through the traction motors to cool them. A small feed is also taken to ventilate the control cubicle.

21.6 **Compressor** supplying compressed air for the locomotive brakes, sanders, horns, windscreen wipers and operation of the control gear.

21.7 **Two exhausters,** providing vacuum for the train brakes, but not the locomotive brakes, will only operate when the engine is running and master controller moved from the 'Off' position.

21.4 **Radiator fan** drawing air through the radiators of the engine cooling circuit.

21.8 **Combined pump set,** driven by one motor, consists of three pumps. These are :—

(a) Engine fuel transfer pump.
(b) Lubricating oil priming pump.
(c) Coolant pump.

The set may be stopped immediately after the engine has been shut down, except when the engine has been shut down from full load. In this case the pump set must then be run for 2 minutes afterwards.

CONTROL CUBICLE

Fault Indicator Panel

21.10

1. CONTROL CIRCUIT BREAKER which acts in a similar way to the fuse by isolating the control circuit if a fault develops.
2. EXHAUSTER SWITCHES 'A' AND 'B' which are normally in the 'On' position.
3. BATTERY AMMETER, indicating the current passing either to or from the battery, should always register on the 'charge' side when the engine is running. The charge may vary between 0 and 100 amps.
4. BRAKE 'FITTED/UNFITTED' SWITCH, varying the rate of brake application on the loco only, should be set to the correct position 'Fitted' or 'Unfitted' depending on the make-up of the train. When running light, the switch must be put to 'Fitted'. (switch may now be marked 'Passenger/Goods').
5. CUBICLE LIGHT SWITCH controlling the lights in the control cubicle.

Indication of 'relay tripped' and reset buttons are provided on the panel for the relays below. On D5176-5232 the 'relay tripped' indicators are flag type, showing black when normal and black and yellow when tripped. On the remaining locomotives they are lights, which show bright when the relay has tripped.

6. 'WATER FAILED' RELAY.
7. 'OIL FAILED' RELAY.
   These relays (6 & 7) will trip when the respective pressures have fallen below the safety limit. The engine will stop and the 'Engine stopped' and the 'Fault' lights on the driver's panel will show bright.
8. 'WATER HOT' RELAY.
   This will trip if the engine is overheated, and the 'Fault' light on the driver's panel will show bright. If it trips both the radiator fan and coolant by-pass valve should be checked. If they are faulty the fan switch should be put in the 'Hand' position, or the by-pass valve lever put in the 'Direct' position. Report any action taken.
9. 'EARTH FAULT' RELAY.
   This will trip when an earth fault occurs on the power equipment and the 'Fault' light on the driver's panel will show bright. All power will be cut from the traction motors and the engine will be reduced to idling speed.
10. 'BLOWER STOPPED' RELAY.
    This will trip if a fault occurs in the blower motor and the 'Fault' light on the driver's panel will show bright.

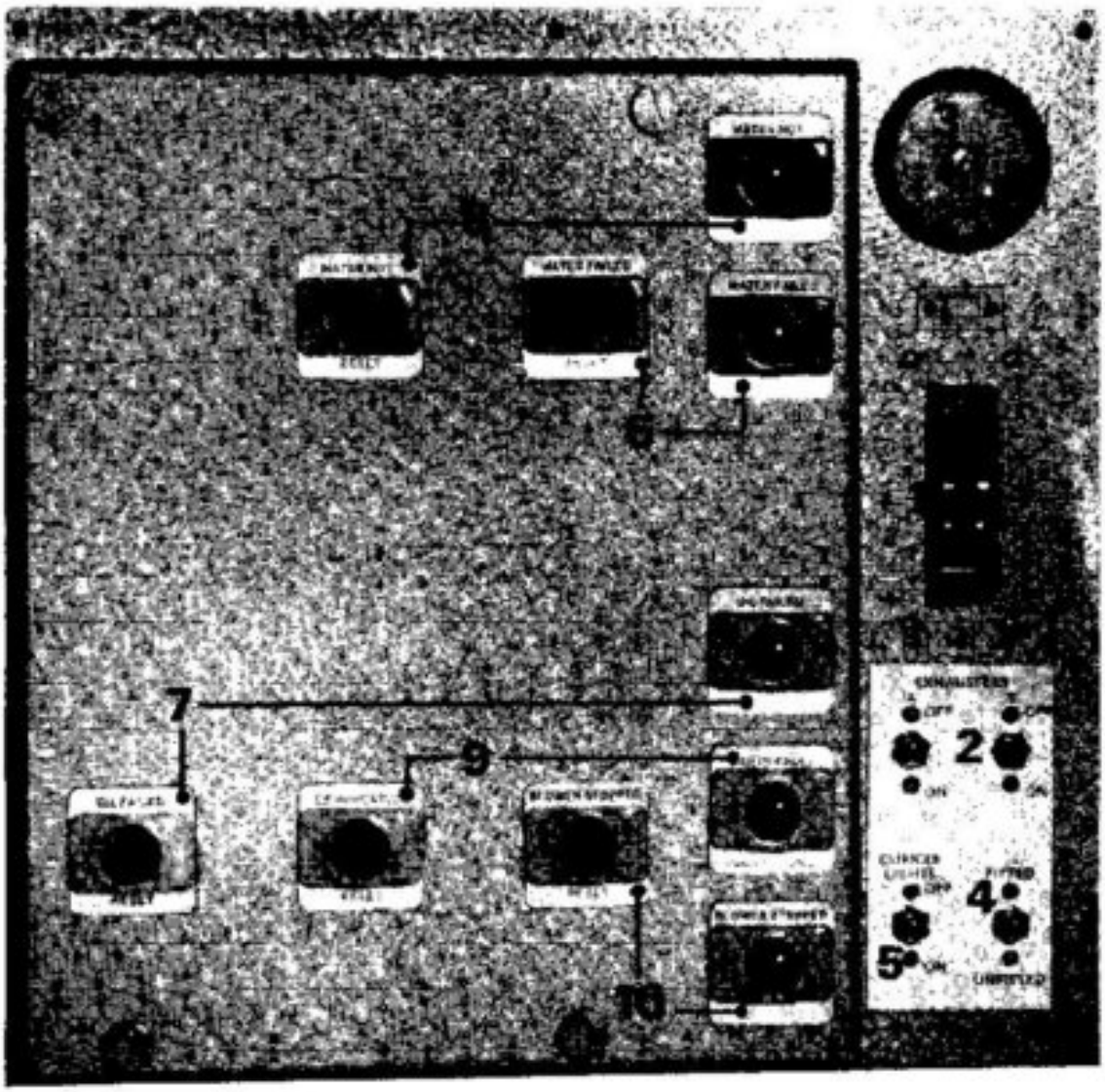


Fig. 22 Fault indicator panel.

ELECTRICAL EQUIPMENT

Switch Panel 21.10

1. ENGINE FAULT SWITCH, which should be switched to 'Fault' position if the pressure charger fails, inserts resistances in the generator field circuit and so limits the output of the generator.
2. EARTH FAULT RELAY ISOLATING SWITCH, which allows the relay to be isolated, is operated following a power earth fault. The locomotive may then continue on restricted power. It is essential that the fault is rectified as soon as possible.
3. EQUIPMENT CUT-OUT SWITCH which isolates all the electrical equipment in the locomotive concerned, but does not affect operation of any other locomotive working in multiple.
4. FIELD DIVERT SWITCH, which allows the traction motor field divert system to be isolated, is used if the motor operated controller fails in any position and is prevented from returned to 'Full Field' position, or, on D7598–D7677, if the electronic equipment fails. It reinstates full field, and allows the locomotive to be operated with full field only.
5. RADIATOR FAN SWITCHES, when in 'Hand' position, enable fan motor to operate continuously if the 'Auto' (Thermostat) control should fail. Always close the low speed switch first.
6. MOTOR CUT-OUT SWITCH, which is used to isolate defective traction motors, has four positions :—

Top	—	Motors all in
Right	—	Motors 1 and 4 out
Left	—	Motors 2 and 3 out
Bottom	—	Motors all isolated

   Traction motor field diversion can only be obtained with the switch in the 'Motors all in' position.
7. CONTROL AIR PRESSURE GAUGE indicating the pressure in the control air reservoir.
8. ENGINE HOURS RECORDER, which is operative as soon as the engine has started, records the total hours that the engine has run.
9. MINIATURE CIRCUIT BREAKERS

CB 10	Hot plates	30 amp
CB 11	Lights	15 amp
CB 12	Sockets	15 amp
CB 13	A.W.S.	15 amp
CB 15	Fire alarm	15 amp
CB 19	Cab heaters	50 amp

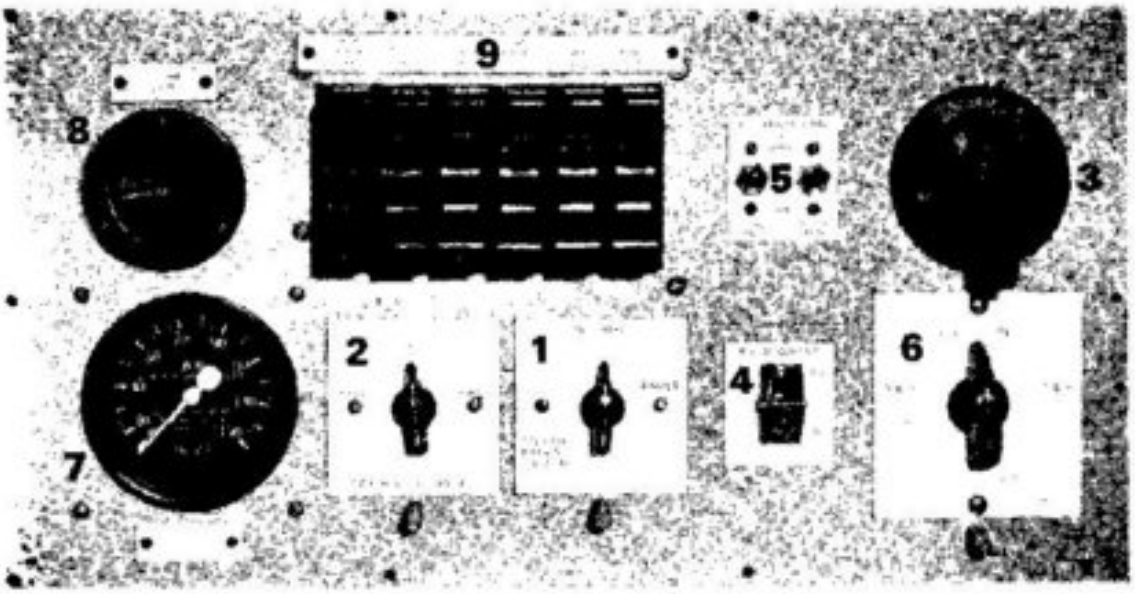


Fig. 23 Switch panel.

Automatic Controls

START CONTACTORS connect the main generator across the battery when the start button is depressed.

REVERSER, acting in response to the master handle on the drivers controller, alters the traction motor connections to reverse the locomotive.

TRACTION MOTOR CONTACTORS connect the traction motors to the main generator.

FIELD DIVERT RELAY operates the field divert controller. An axle driven tacho-generator controls speed sensing relays on D7598–D7677.

FIELD DIVERT CONTROLLER, operated by a small pilot motor in response to the load regulator and the field divert relay, operates the field divert contactors. On D7598–D7677 these are operated by relays under the control of the sensing relays (above).

FIELD DIVERT CONTACTORS, closing in controlled sequence, weaken the field strength of the traction motors by inserting resistances in parallel with their field circuits.

VOLTAGE REGULATOR maintains the auxiliary generator voltage at 110 volts.

AUXILIARY MACHINE CONTACTORS provide control of the auxiliary motors.

CONTROL RELAYS, providing automatic operation of certain parts of the equipment, set up the power circuits.

REVERSE CURRENT RELAY, which is sensitive to current direction, opens or closes the battery charging circuit according to the auxiliary

generator voltage. This is not fitted on D7598–D7677, which have a Battery Rectifier.

EQUIPMENT GOVERNOR is an air operated switch preventing the motor contactors from operating if the air supply to the cubicle is below 50 lbs./sq. in.

AIR CONTROL GOVERNOR, operating if the main air pressure falls below 60 lbs./sq. in., ensures that power is cut off when a fault occurs in the air system causing the main air pressure to fall too low for the safe operation of the locomotive.

VACUUM CONTROL GOVERNOR, operating if the vacuum falls below 12½ in. Hg., ensures that power is cut off when a D.S.D. brake application is made, or when there is loss of vacuum with the locomotive under power.

Fuse Panel

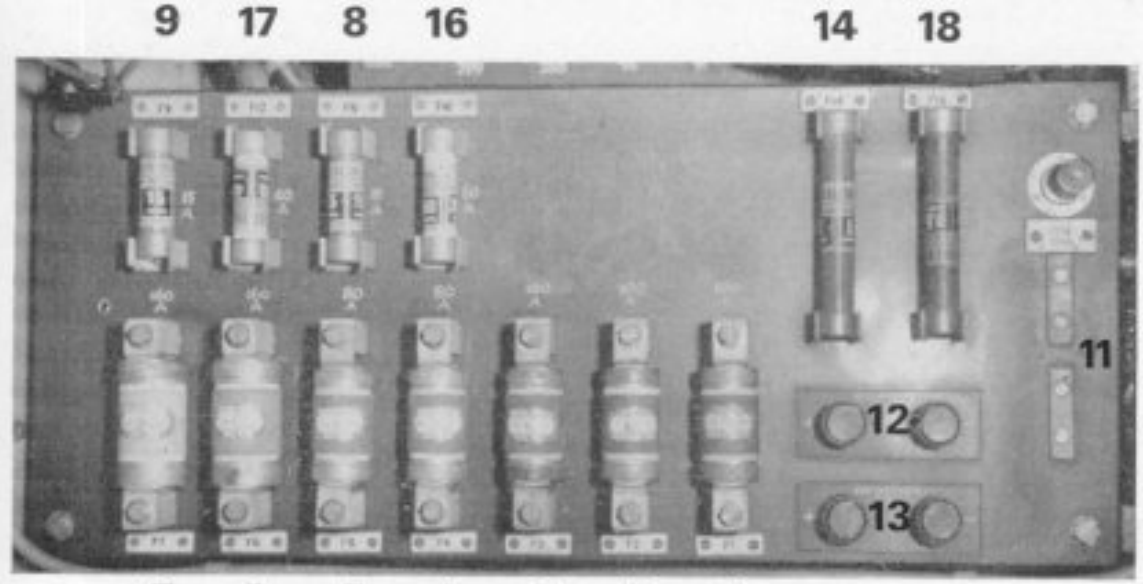
The fuse panel is situated in the control cubicle, with its own access door. Spare fuses are fitted on this door and/or on the panel. The following fuses are on the panel :— 21.11

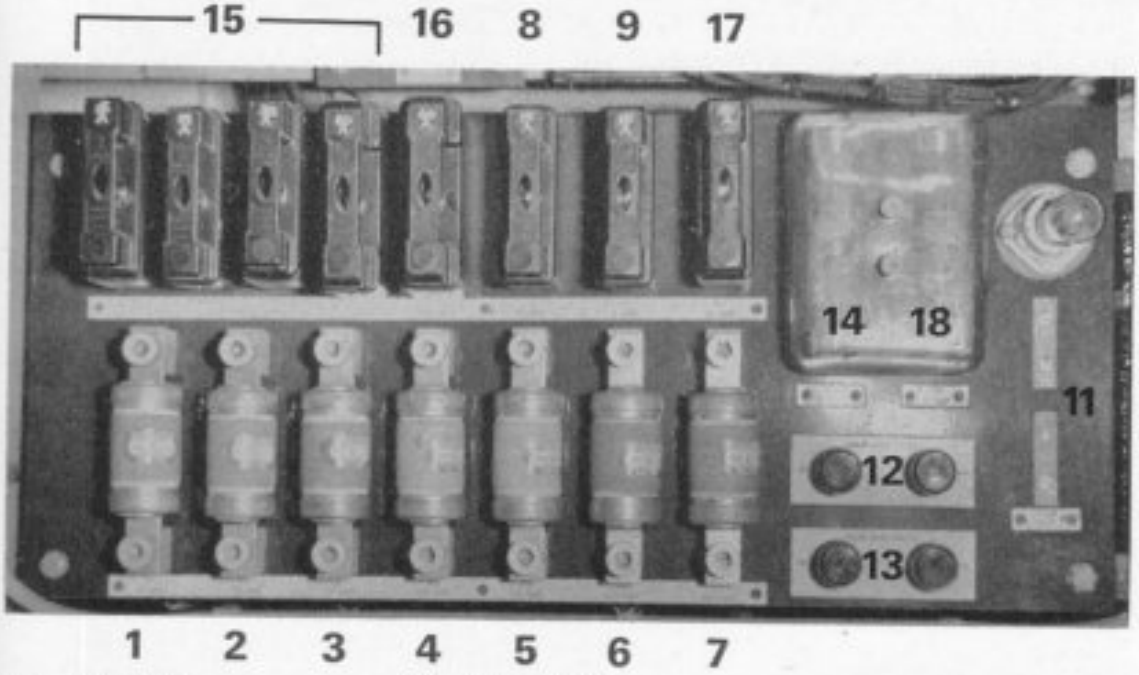
		D5176–232	D5233–99, D7500–677
F1	Battery charge	100 amp	125 amp
F2	Combined pump set	100 amp	125 amp
F3	Compressor	100 amp	125 amp
F4	Exhauster No. 1	80 amp	125 amp
F5	Exhauster No. 2	80 amp	125 amp
F6	Blower motor	160 amp	200 amp
F7	Radiator fan	160 amp	200 amp
F8	Auxiliary generator field	15 amp	15 amp
F9	Auxiliary generator relay and Reverse current relay	15 amp	15 amp
F14	Generator voltmeter terminals	5 amp	5 amp
F16	Steam generator	60 amp	80 amp
F17	Main generator separate field	40 amp	30 amp
F18	Main generator self field	15 amp	15 amp

FUSE TESTER

The fuse tester is situated on the fuse panel, the sequence of operation being as follows :— 24.11

(a) Put the battery isolating switch to 'Off'. 25.1
(b) Ensure that CB11 (on the switch panel) and control circuit breaker (on the fault indicator panel) are both switched to 'On'. 23.9 22.1
(c) Remove the suspect fuse.
(d) Holding the fuse by the centre portion, place it across the tester contacts. If it is satisfactory, the lamp will light.
(e) After replacing a serviceable fuse, put the battery isolating switch to 'On'.





1. Fuse F.1.
2. Fuse F.2.
3. Fuse F.3.
4. Fuse F.4.
5. Fuse F.5.
6. Fuse F.6.
7. Fuse F.7.
8. Fuse F.8.
9. Fuse F.9.
11. Fuse tester terminals and lamp.
12. Main generator voltage check terminals.
13. Auxiliary generator voltage check terminals.
14. Fuse F.14.
15. Spare fuses.
16. Fuse F.16.
17. Fuse F.17.
18. Fuse F.18.

Fig. 24 Fuse panels: top for D5176-5232, below for remainder.

ELECTRICAL EQUIPMENT

BATTERY

The main function of the battery is to provide power to motor the generator for engine starting and current for the auxiliaries and control gear until the engine is running. It is housed in two containers under the locomotive frame between the bogies. 2.15

Battery Isolating Switch

This isolates the battery from all electrical equipment except lights, fuse tester and fire extinguishers. It must be operated only when the engine is stopped and must be put to 'Off' before leaving the locomotive. It must also be put to 'Off' before touching any equipment on the control cubicle. The switch is situated in the engine room against the bodyside, and can be operated from inside or outside the locomotive. 25.1

LIGHTING

The following, all on the 110 volt circuit, are switched from a panel mounted inside the cab roof :—

- Cab light (40W)
- Engine room lights (40W)
- Boiler compartment lights (40W)
- Route indicator lights (40W)
- Hand lamps (40W)
- Rear lights (25W)
- Panel illumination (15W)

The warning lights on the drivers panel are 6 volt, 3 W.

SHORE SUPPLY

A shore supply panel, accessible from outside the locomotive, contains the lighting change over switch. When switched to SHED, power for locomotive lights may be obtained from a 110 volt shore supply, using the adjacent socket. There are also a socket for battery charging from a shore supply and two terminals for emergency engine starting from an external supply. f.25

Key to fig. 25 (right)

1. Battery isolating switch.
2. Lighting change over switch.
3. Lighting shore supply socket.
4. Battery charging socket.
5. Terminals for emergency engine starting.

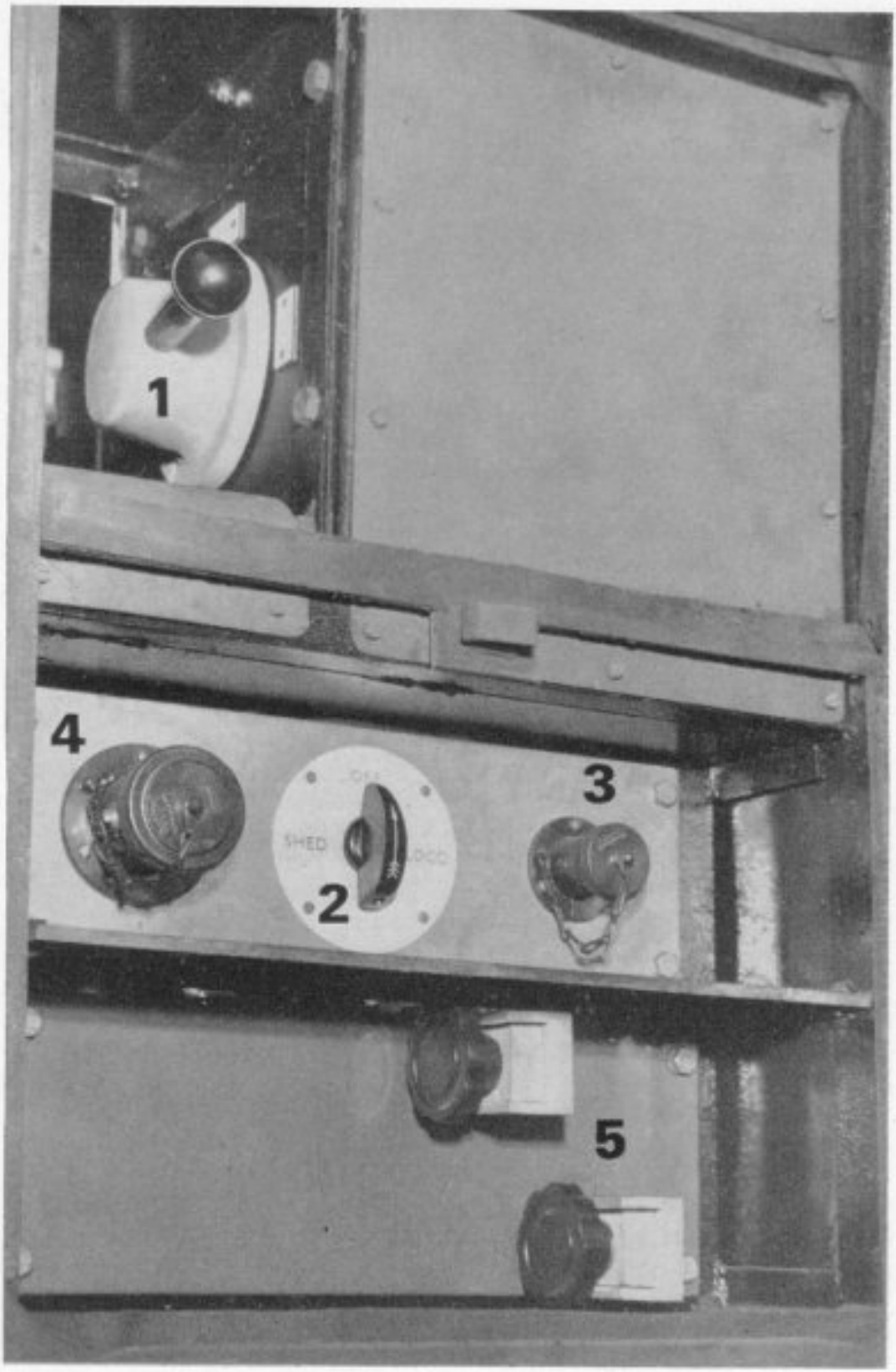


Fig. 25 Battery isolating switch and shore supply panel.

AIR SYSTEM

GENERAL

The Metcalfe-Oerlikon air system incorporates both air and vacuum brake systems, and supplies air to the control and engine regulating systems and to accessories such as the horns and windscreen wipers. f.26 p.30

BRAKE SYSTEMS

Air Brake

The locomotive is fitted with vacuum controlled air brakes. Air is supplied to the main reservoir by the compressor which is controlled by a governor to maintain the air pressure between 85 and 100 lb/sq. in. A safety valve releases the pressure at 110 lb/sq. in. and a control governor cuts the traction motor circuits should the air pressure fall to 60 lb/sq. in.

The main reservoir supplies air to an auxiliary reservoir which provides extra capacity in case of failure of the main reservoir or compressor. The driver's air brake valve is connected to the main reservoir loco pipe and regulates the amount of air to the relay valves. These valves can deal with a greater volume of air to the brake cylinders than the driver's air brake valve, and regulate this air in proportion to the air from the driver's brake valve. 28.5

Vacuum Brake

When coupled to a train fitted with vacuum brakes the locomotives are braked by compressed air in the brake cylinders controlled proportionately with the vacuum system by two triple valves. Two exhausters create the vacuum and are connected to the vacuum train pipe. The driver's vacuum brake valve is also connected to this pipe and can lower the degree of vacuum in it against the exhausters to apply the brakes on the train. A connection from this pipe to the triple valve allows the triple valve to correspondingly control the air to the brake cylinders from the auxiliary reservoir in proportion to the braking by the train vacuum brakes. 28.4 28.3

By operating the button on the power handle an antislip brake application can be made by an electro-magnetic antislip valve which supplies air to the triple valves from the control air reservoir. This air causes the triple valve to pass air at low pressure to the brake cylinders giving a light brake application.

A valve operated by the 'passenger/goods' switch alters the rate at which the locomotive brakes are applied during a driver's safety device application. When the switch is in the 'goods' position the rate is slower. When running 'light locomotive' the switch must be placed into the 'passenger' position. 22.4

Key to Fig. 26 (overpage)

1. Aftercooler pipe—D5176-5232, D7568-7597 only.
2. Air compressor.
3. Air filter and relief valve—D5176-5232, D7598-7677 only.
4. Air line sieve.
5. Air strainer and check valve—D5233-5298, D7500-7597 only.
6. Air suction strainer—not on D7598-7677.
7. Anti-freeze unit—not on D7598-7677.
8. Auxiliary air reservoir.
9. Brake cylinder.
10. Centrifugal air strainer.
11. Check valve.
12. Check valve with choke.
13. Compressor governor switch.
14. Control governor switch.
15. Control air reservoir.
16. Control reservoir.
17. Control reservoir cross connecting pipe—D5233-5298, D7500-7567, D7598-D7677 only.
18. D.S.D. cut out cocks and cross connecting pipe—not fitted on D7598-7677, which have line from 19 joining air cross connecting pipe between items 38.
19. D.S.D. valve.
20. Double check valve.
21. Drain cock.
22. Drip cup.
23. Driver's air brake valve.
24. Driver's vacuum brake valve.
25. Dummy coupling.
26. Duplex air valve.
27. Duplex check valve.
28. Duplex pressure gauge.
29. Duplex vacuum gauge.
30. Electro-pneumatic valve—anti-slip brake.
31. Electro-pneumatic valve—passenger/goods changeover.
32. Electro-pneumatic valve—forward/reverse sanding.
33. Electro-pneumatic valve—remote horn control.
34. End cock.
35. End coupling with valve.
36. Engine control cut out cock.
37. Engine power handle drum.
38. Engine speed air control valve.
39. Exhausters—
    D5233-5298, D7500-7597 Northey 125 REFM.
    D5176-5232, D7598-7677 Reavell RFU.
40. Exhauster choke valve.
41. Exhauster relief valve and pipe—D5233-5298, D7500-7597 only.
42. Exhauster silencer—not on D7598-7677.
43. Expansion reservoir.
44. Flexible hose and coupling.
45. Flexible hose end connection.
46. Isolating cock.
47. Main reservoir.
48. Pneumatic horn.
49. Quick release valve.
50. Reducing valve.
51. Refuelling group—fitted only on some locomotives.
52. Relay valve.
53. Relief valve—D5233-5298, D7500-7597 only.
54. Reverser drum.
55. Sandtrap and ejectors.
56. Safety valve.
57. Single pressure gauge—control air and feed to control cubicle.
58. Single pressure gauge—main reservoir.
59. Timing reservoir (deadman's valve).
60. Triple valve.
61. Vacuum governor—D5176-5232, D7568-7597 only.
62. Vacuum governor—D5233-5298, D7500-7567, D7598-7677 only.
63. Windscreen wiper.
64. Windscreen wiper control valve.

AIR SYSTEM

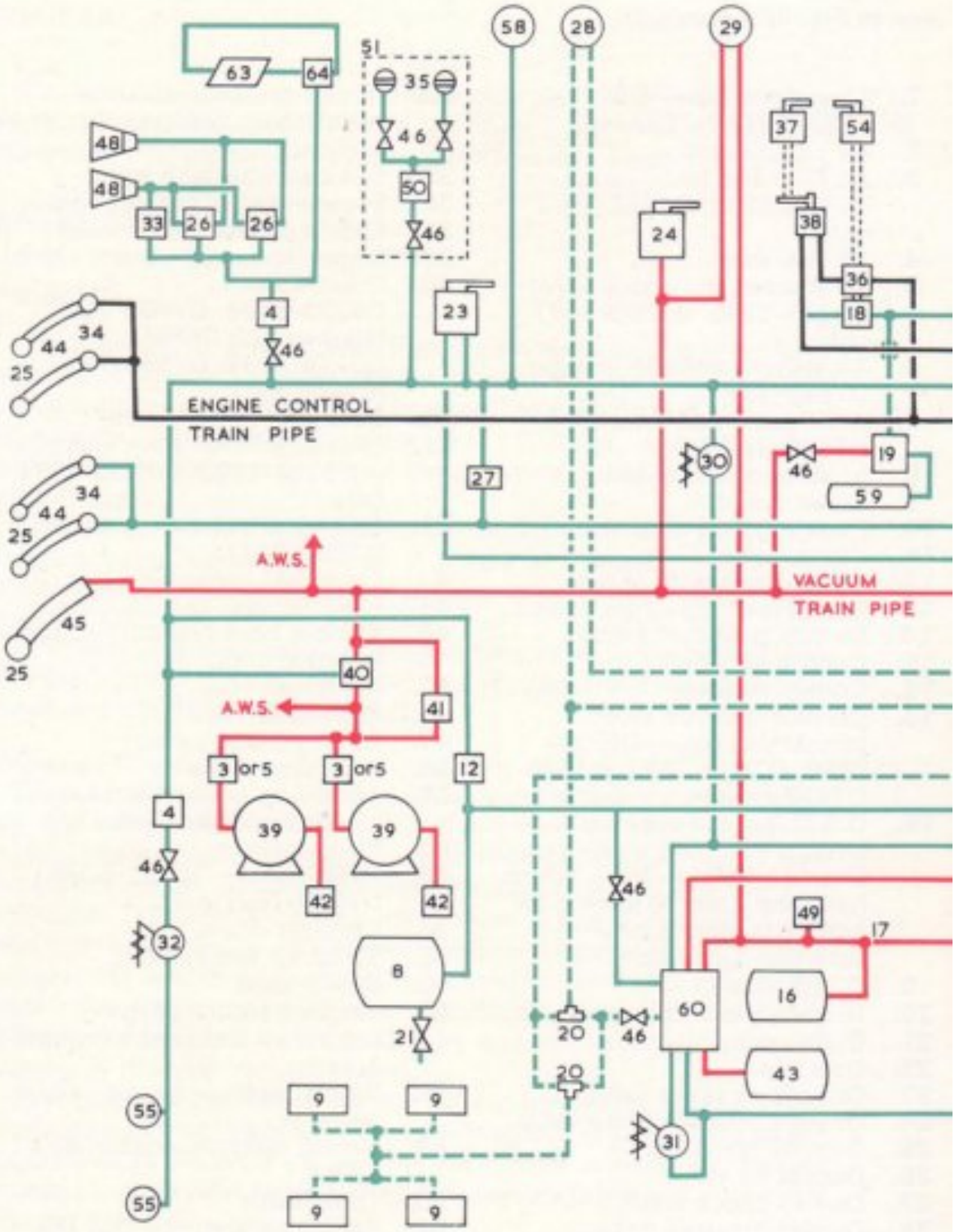
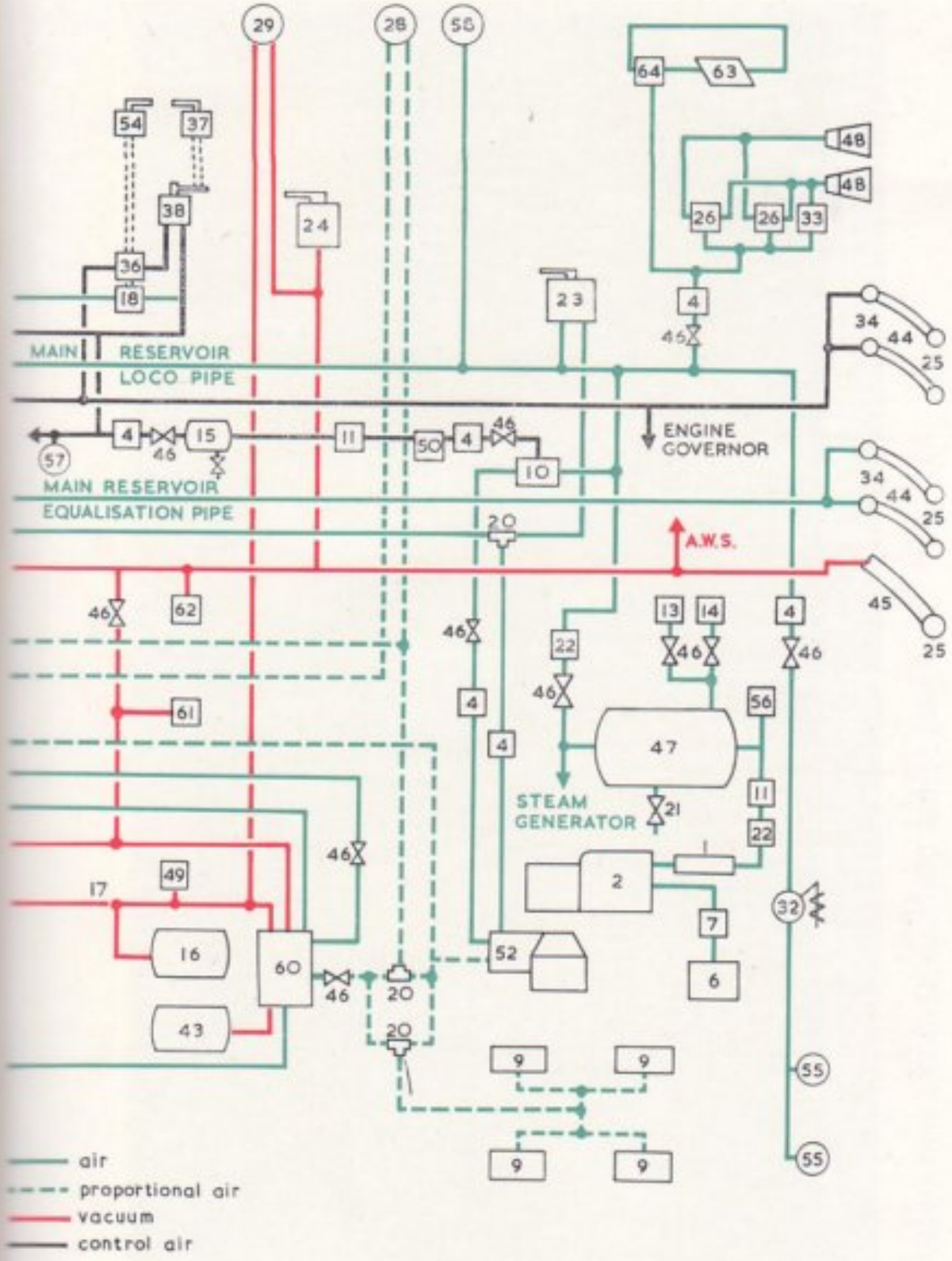


Fig. 26 Schematic diagram of air system.

AIR SYSTEM


MAIN RESERVOIR
LOCO PIPE
MAIN RESERVOIR
EQUALISATION PIPE
ENGINE GOVERNOR
A.W.S.
STEAM GENERATOR
air
proportional air
vacuum
control air

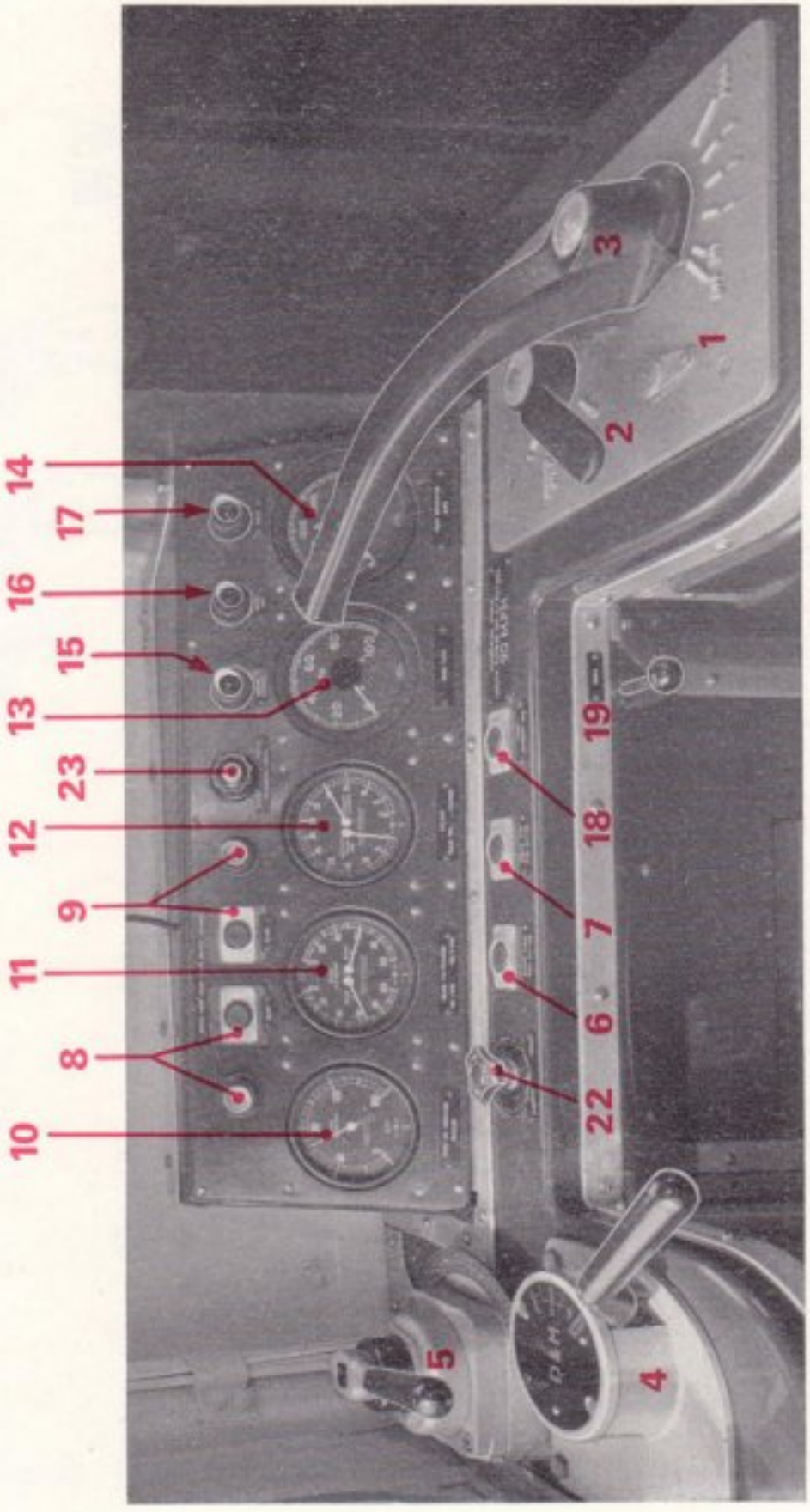


Fig. 27 Driver's desk D5176-5232, D7568-7597.

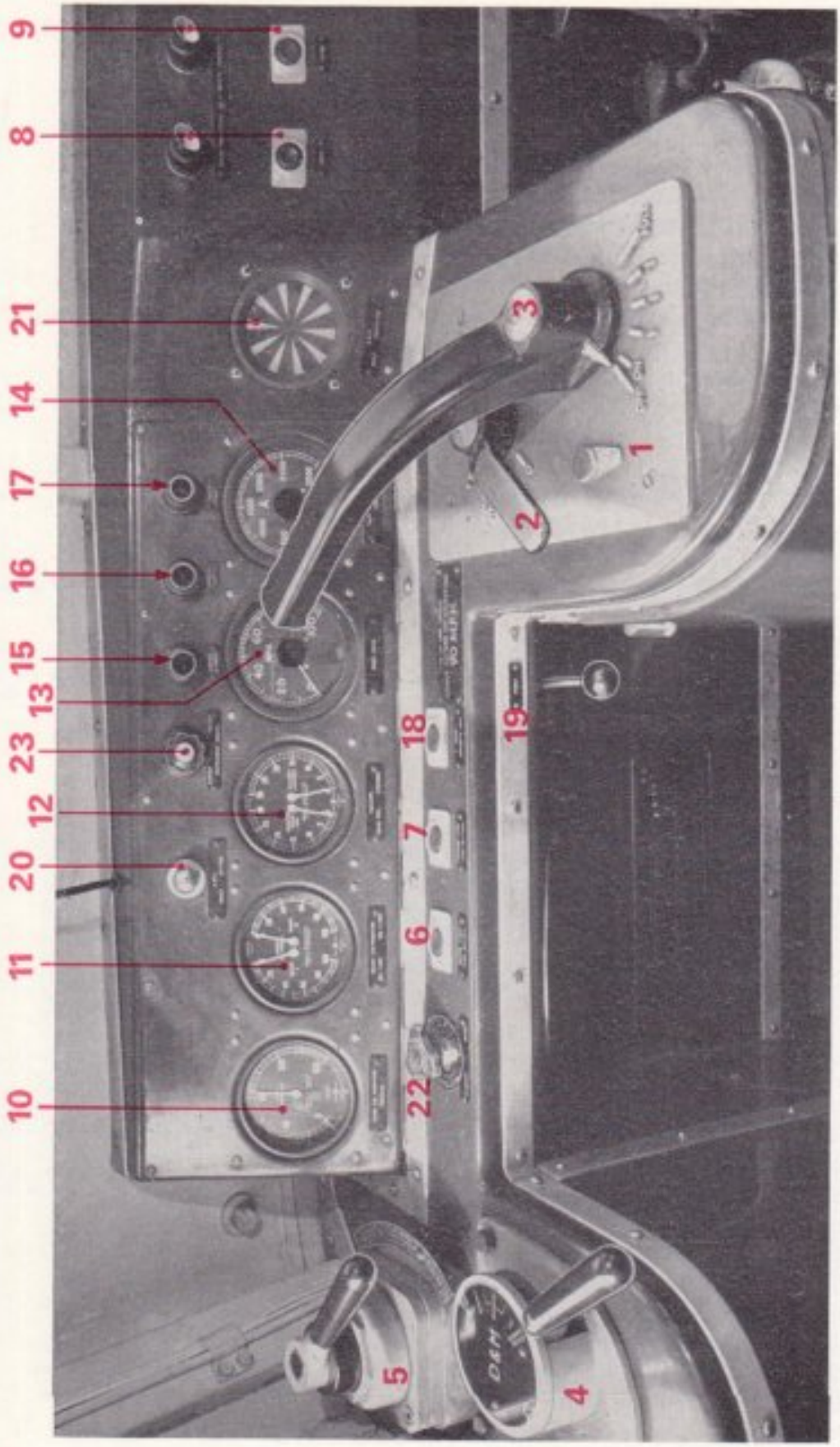


Fig. 28 Driver's desk D5233-5298, D7500-7567, D7598-7677.

DRIVING COMPARTMENT

DRIVERS DESK

f.27, f.28

1. **Master Key,** which is inserted at the position indicated, has to be turned before the controls can be moved. The reverser handle is locked in the off position when the key is removed.
2. **Reverser Handle,** controlling the reverser in the control cubicle, alters the current through the traction motor field windings for reverse rotation. It has four positions—'Off', 'Reverse', 'Engine only' and 'Forward'. It must be to 'Engine only' for starting the engine and pre-running of engine auxiliaries and must not be moved unless the locomotive is stationary.
3. **Power Handle,** controlling the power to the traction motors by adjusting the diesel engine speed and thus the output of the generator to the traction motors, has positions marked 'Off', 'On', '$\frac{1}{4}$', '$\frac{1}{2}$', '$\frac{3}{4}$' and 'Full'. The positions 'On' and '$\frac{1}{4}$' are definite notches which can be detected, whereas the other positions are only graduations between '$\frac{1}{4}$' and 'Full'.

   On the end of the power handle is fitted the Anti-Slip Button.
4. **Vacuum Brake Handle,** controlling both train and locomotive brakes, has positions 'Running', 'Release', 'Lap', 'Braking' and 'Emergency'. 26.24
5. **Air Brake Handle** controlling the air brake on the locomotive only. 26.23
6. **Engine Start Button** which can only be operated with the reverser handle at 'Engine only'.
7. **Engine Stop Button** which will stop the engine from both driving and non-driving cabs.
8. **Open Button**
9. **Close Button**

   with indicator lights, are for remote control of main steam valve from steam generator to steam heating connections. These buttons do not start or shut down the steam generator, but control the steam supply when coupling to or uncoupling from the train.
10. **Main Reservoir Gauge** indicating the air pressure in the main reservoir supplying the brake and control systems. 26.58
11. **Brake Cylinder Pressure Gauge** of the Duplex type, having two pointers marked 'Bogie I' and 'Bogie II'. 26.28
12. **Vacuum Gauge** of the Duplex type, having two pointers which indicate inches of Vacuum in the Train Pipe (left) and Vacuum Chamber of the triple valves on the locomotive (right). 26.29
13. **Speedometer** indicating locomotive speed which must not exceed 90 m.p.h. under any condition.
14. **Ammeter,** indicating the total current being supplied to the traction motors, but not the power output of the locomotive.
15. **Engine Stopped light** (red) which should normally be dim when the engine is running and bright when stopped.

16. **Wheel Slip Light** (amber), which should normally be dim, but if it is bright indicates wheel slip, or a fault in one of the traction motors.
17. **Fault Light** (blue) which should normally be dim, but if it is bright indicates one of the following :—

p.27
(a) High coolant temperature.
(b) Loss of air pressure or vacuum (when the power handle is away from 'Off').
p.34
(c) Earth fault relay tripped (when the power handle is away from 'Off').
(d) Blower motor failure.

18. **Horn Button** for opposite end.
19. **Horn Lever**
20. **A.W.S. Reset Button**
21. **A.W.S. Indicator**
22. **Window Wiper Control**
23. **Instrument Lights Dimmer Switch**

Drivers Safety Device (foot pedal) which will apply the brake automatically if it is released with the reverser handle at 'Forward' or 'Reverse'.

Sanding Switch (foot operated) is situated beside the Driver's Safety device pedal.

' 29
A W S unit is situated on the cab floor between the driver's seat and the cab side wall. There is a unit in each cab.

There are two types of A.W.S. units in use. One is an earlier and

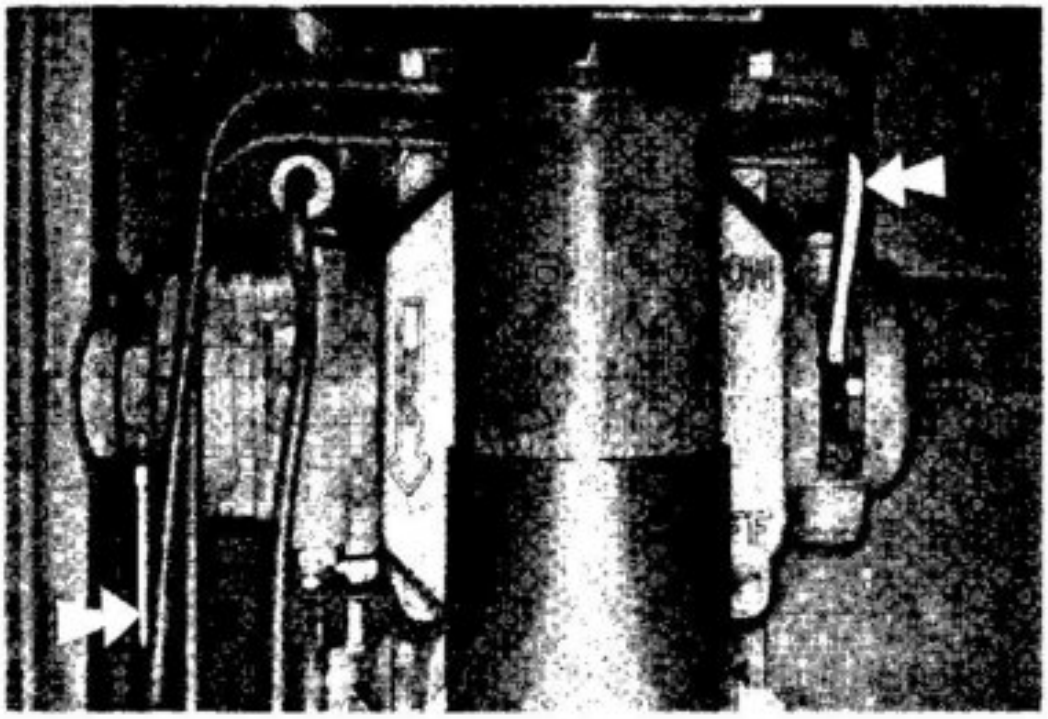


Fig. 29 A.W.S. switch unit.

established type painted green and fitted with one fixed and one removeable handle. The other is painted blue and has both handles fixed. This latter type will eventually replace the green painted one.

With the blue painted type of A.W.S. unit the A.W.S. is operative only when the unit in the driving cab has both handles in the up position, and the unit in rear cab has the left hand handle in the up position and the right hand handle down in the 'off' position. No control current is supplied to the controller until the handles on both units are in these positions.

SECOND MAN'S POSITION

1. **Loco Brake Release Lever,** which releases the locomotive brakes but has no effect on the vacuum brakes of an attached train, allows the locomotive brakes to be released after use of the vacuum brake handle while the train vacuum remains destroyed and the brakes on. 26.49
2. **Handbrake position indicator** showing whether the hand-brake is 'On' or fully 'Off'.
3. **Handbrake Wheel**
4. **Window Wiper Control**
5. **Instrument Lights Dimmer Switch**
6. **Boiler Warning Light** which should normally be dim, but if it is bright indicates a fault on the steam generator.
7. **Boiler Pressure Gauge** indicating the steam pressure for train heating.
8. **Horn Lever**
9. **Driver's Safety Device Holdover Button** which, when pressed, prevents a brake application by the Driver's Safety Device.

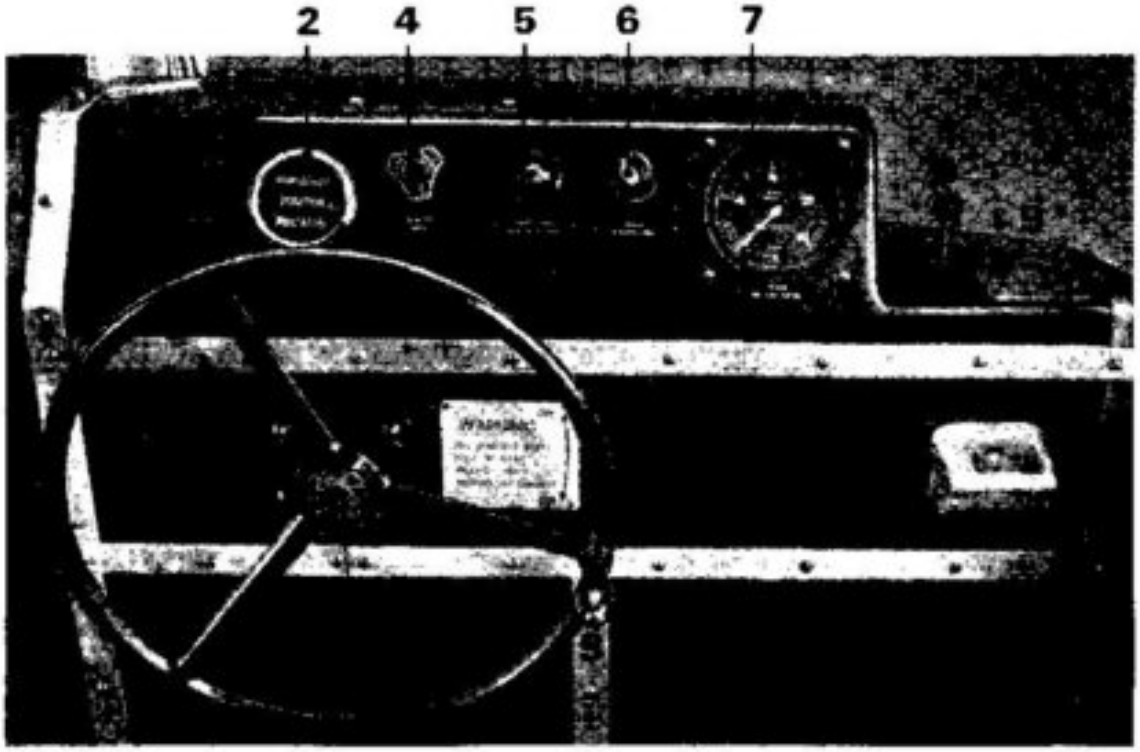


Fig. 30 Second man's position D5176-5232, D7568-7597.

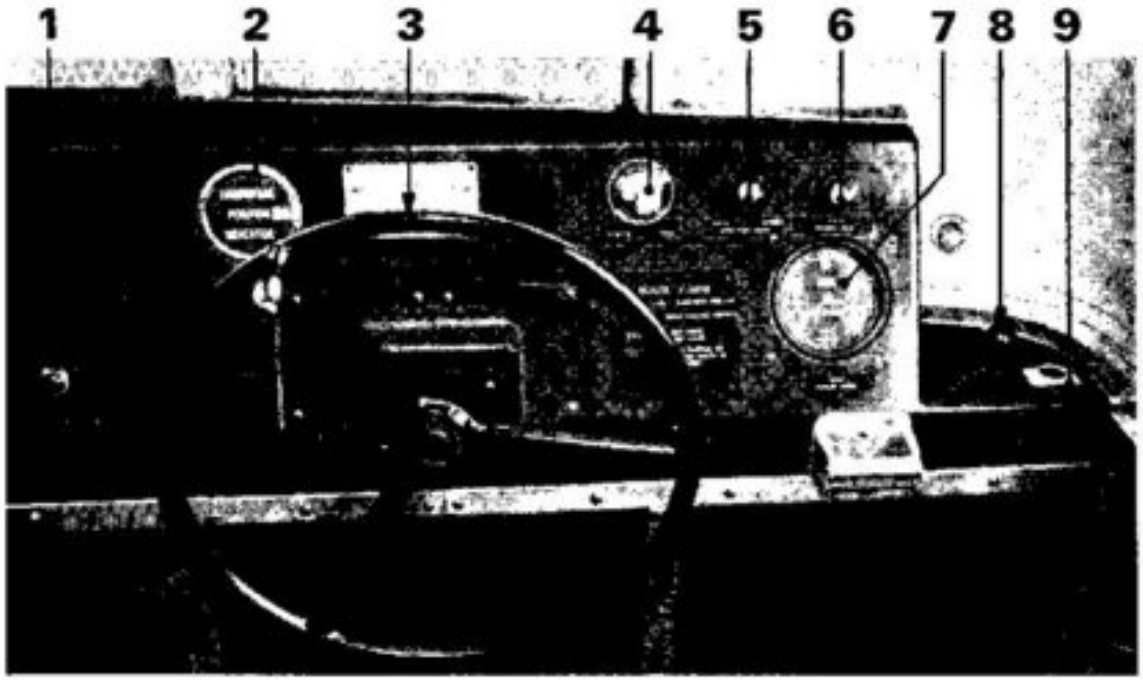


Fig. 31 Second man's position D5233-5298, D7500-7567, D7598-7677.

STEAM GENERATOR

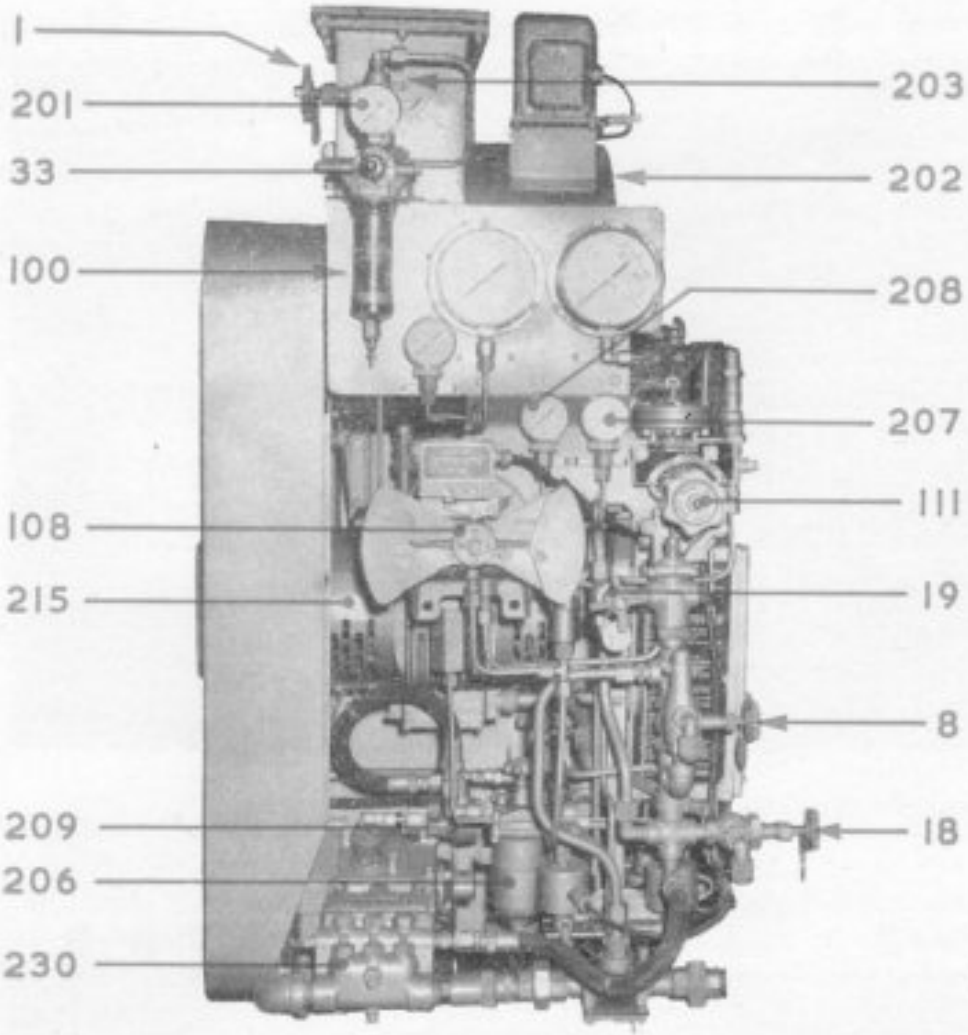


Fig. 32 Steam generator—front view.

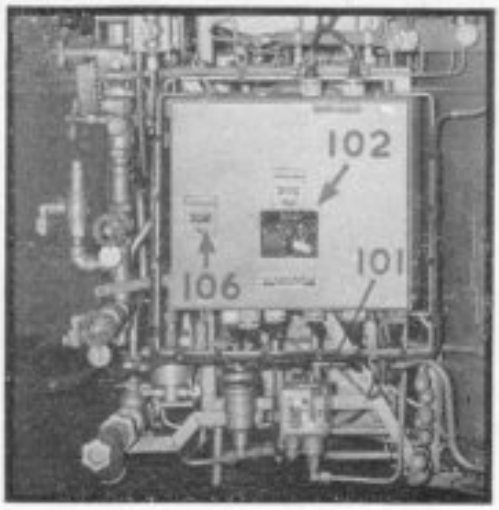


Fig. 34 Steam generator—view on control panel.

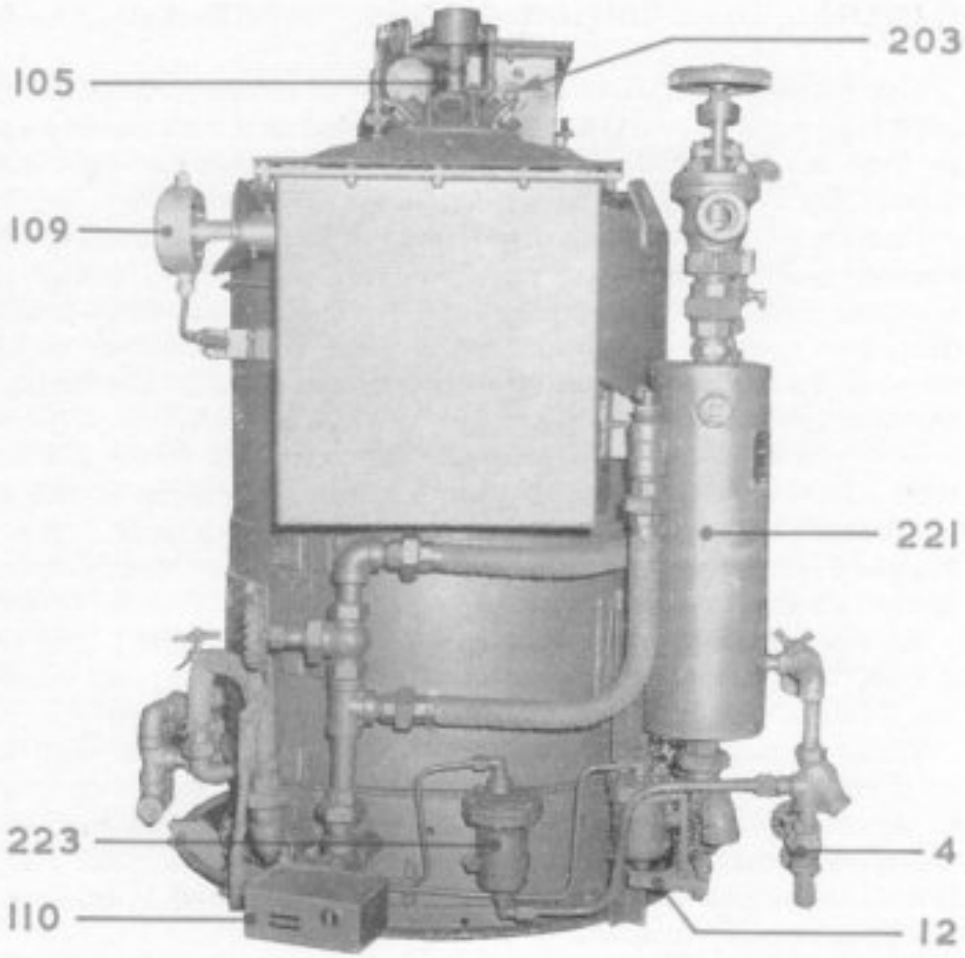


Fig. 33 Steam generator—rear view.

1. Atomising air admission valve.
4. Fill test valve.
8. Manual water by-pass valve.
12. Separator blowdown valve.
18. Water pump test valve.
19. Water by-pass regulator shut off valve.
33. Admission valve to atomising pressure gauge.
100. Atomising air pressure regulator.
101. Atomising pressure switch.
102. Control switch.
105. Fuel spray head.
106. Overload reset button.
108. Servo fuel control.
109. Stack switch.
110. Steam temperature limit control.
111. Water by-pass regulator.
201. Atomising air gauge.
202. Fan.
203. Damper spindle.
206. Fuel filter (Suction line).
207. Fuel nozzle pressure gauge.
208. Fuel system pressure gauge.
209. Fuel pump.
215. Driving motor.
221. Steam separator.
223. Steam trap.
230. Water pump.

STEAM GENERATOR

GENERAL DESCRIPTION—STONE VAPOR TYPE L 4610.

The Stone Vapor Steam Generator is a forced circulation water tube boiler with several sets of coils nested and connected in series to form a single coil of steel tubing several hundred feet long in which the steam is produced. f.32 f.33 f.34

Operation is completely automatic after the steam generator is started, and full operating steam pressure is reached within a few minutes. Every component bears a number, valves each bearing a disc, the number on which tallies with those referred to in the manual. Valves designated by letters are provided by the locomotive manufacturer.

The valves designated by odd numbers and fitted with cross type handles must be OPEN during normal operation of the steam generator. Valves designated by even numbers and fitted with standard round handles must be CLOSED during normal operation of the steam generator.

An electric motor (215) drives a three piston water pump (230), a gear type fuel pump (209) and a blower (202) for providing combustion air, all at constant speed.

Water is pumped into the coils inlet and converted into steam as it passes through the coils. These are heated by the combustion of diesel fuel oil which is forced by compressed air through the atomising nozzle (105) into the fire pot above the coils. Here the fine spray mixes with the air from the blower and is ignited by a continuous electric spark.

Ninety per cent of the water is evaporated ; the remainder is carried over with the steam to the steam separator (221) where water and sludge are removed before the steam flows into the steam line.

The excess water passes to the steam trap (223), then returns to the water tank except in locomotives D 5176–D 5178 where it goes to waste outside the locomotive.

Sludge is removed from the separator through the separator blowdown valve (12). This can be foot operated, but is opened automatically for 5 seconds every 5 minutes, operated by fuel oil pressure and an electrical timing switch.

The output of the steam generator can be adjusted by the hand wheel on the water by-pass regulator (111). Once set, this automatically controls the steam generator output by regulating the amount of water fed to the coils. The servo fuel control (108) (hydraulically operated by fuel oil pressure), admits fuel to the spray nozzle in direct proportion to the amount of water entering the coils, and also adjusts the damper control (203) to the correct amount of air for efficient combustion.

Temperature Switches.

STEAM TEMPERATURE CONTROL SWITCH (110), operates in two stages :— f.33

(a) 12° of superheat (approx.). The fuel bypass solenoid valve (122) opens modifying the action of the fuel servo control, so that, for a given quantity of water, less fuel is passed to the boiler. The fault light in the cab remains dim, and, when the steam temperature drops, the bypass valve (122) will close and the fuel servo control will return to normal.

(b) 42° of superheat (approx.). The boiler will shut down and the fault light in the cab will glow brightly. The boiler must be cool and the re-set button on the temperature control switch (110) must be pressed before the steam generator can be started.

STACK TEMPERATURE CONTROL SWITCH (109) operates if the stack temperature becomes too high, or if the combustion of the fuel oil fails. In either case the steam generator will shut down and the fault light in the cab will glow brightly. The re-set button under the screw cap in the top of the stack switch must be pressed before the steam generator can be started. f.33

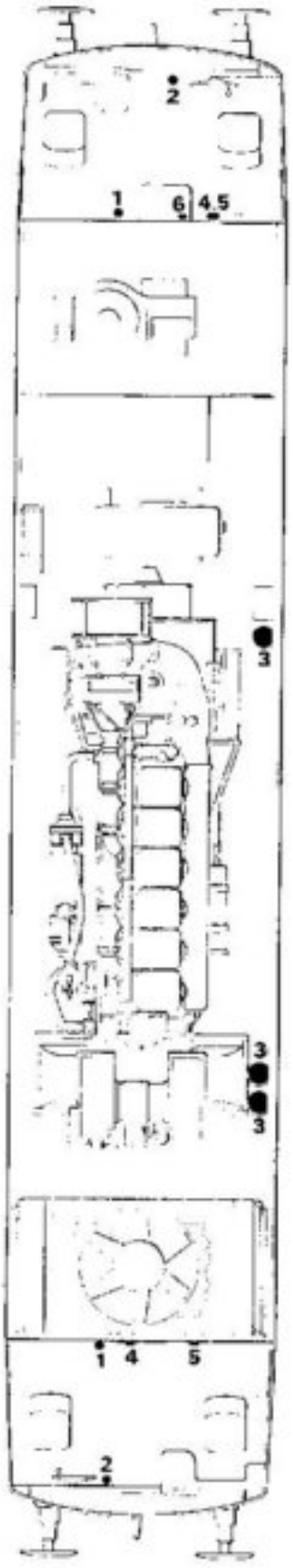


Fig. 35 Location of fire fighting equipment.

FIRE FIGHTING EQUIPMENT

GENERAL

The locomotive is provided with gas and gas expelled water equipment to deal with internal fires emanating from either oil or electrical faults, and with external fires under the locomotive. The water type should be used for external fires.

EQUIPMENT

f.35 The equipment is as follows :—

1. **Hand extinguisher (CO_2 water)**—one on each cab rear bulkhead.
2. **Hand extinguisher (CO_2gas)**—one on each cab front bulkhead.
3. **CO_2 large extinguishers**—3 in engine room.
4. **Alarm bell**—one on each cab rear bulkhead.
5. **Pull handle**—one on each cab rear bulkhead.
6. **Test button**—one on No. 2 cab rear bulkhead.

When the ambient temperature is sufficiently high the detector heads will cause the alarm bells to ring.

The engine room, boiler and brake compartments have a fire extinguishing system incorporated which is supplied by three large CO_2 bottles. These bottles fill the engine room and compartments with CO_2 gas, thus depriving the fire of necessary oxygen. The detecting heads only cause the alarm bells to ring; the bottles are discharged by pulling any of the handles in the cabs or on the locomotive sole bar. The pull handles release the bottles mechani-
f.36 cally so long as the safety pins preventing the bottles being discharged accidentally have been withdrawn.

PRECAUTIONS

In the course of normal routine a few precautions should be carried out in order to assist dealing with the emergency of a fire.

1. Always keep the engine room doors and trailing cab windows shut so that should a major fire break out in the engine room it is not ventilated from behind and the CO_2 rendered ineffective.
2. When taking over a locomotive check that the pins in the three CO_2 bottles have been unscrewed and removed.
3. When taking over a locomotive check that by pressing the fire alarm test button on the driver's desk the fire alarm system will

ring the alarm bells, and that the hand extinguishers are in their proper places.

4. When making a walk through the engine room check that there are no rags or waste cloth lying about, as these can be a contributory cause of fire.

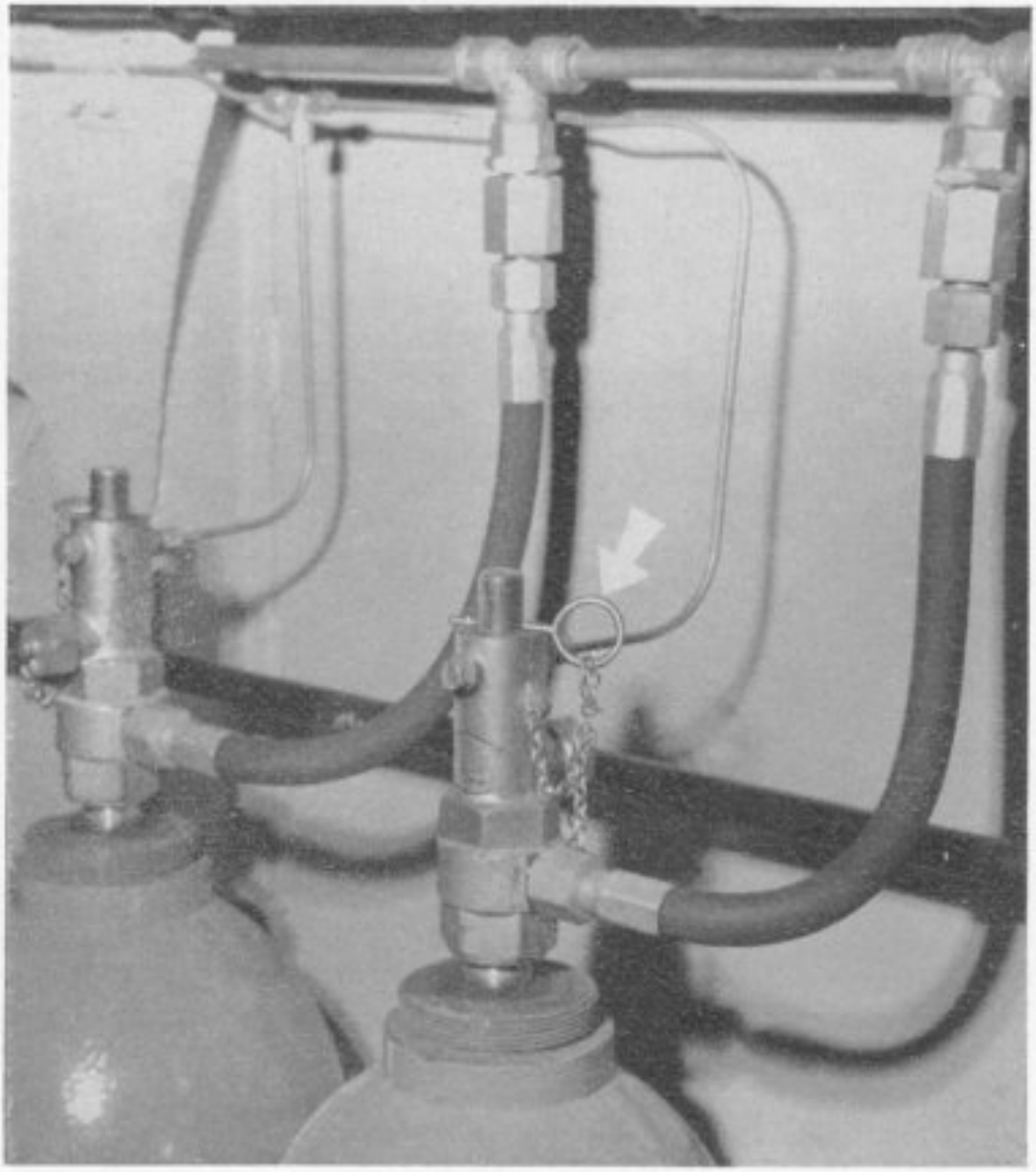
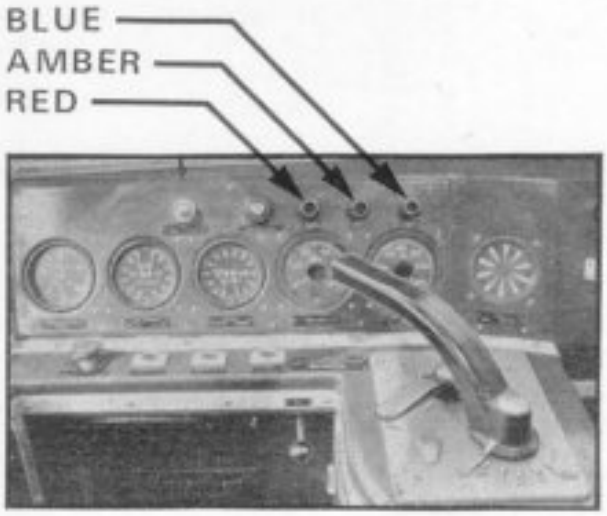


Fig. 36 Safety pin in CO_2 bottle.

In the fault finding sections which follow, it is assumed that the locomotive is being driven from No. 1 cab and so the relevant cab equipment is indicated only in No. 1 cab. The same items in No. 2 cab, although not indicated, could also apply.

The red, blue, and amber lights mentioned are the red, blue and amber cab alarm lights as shown below :—



FAULT FINDING CONTENTS

LOCOMOTIVE

When Starting

60 Desk alarm lights do not come on.
62 Engine will not start—Red light bright.

In Service

65 Blue light bright—No loss of power
68 —No power, or power is lost.
71 Engine stops–Red light bright.
75 Amber light bright.
76 No power on opening controller.
79 Apparent lack of power—No warning indication.

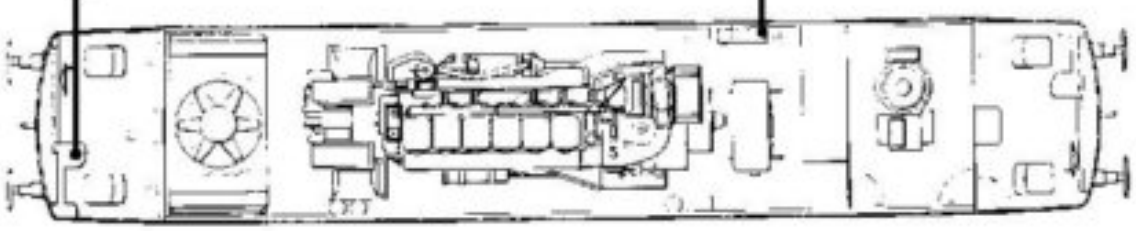
STEAM GENERATOR

82 Motor starts but burner does not light.
86 Steam generator shuts down during operation—fault light bright.
88 Steam generator fault light goes out.

DESK ALARM LIGHTS DO NOT COME ON

1. Check reverser handle is at 'Engine Only'.

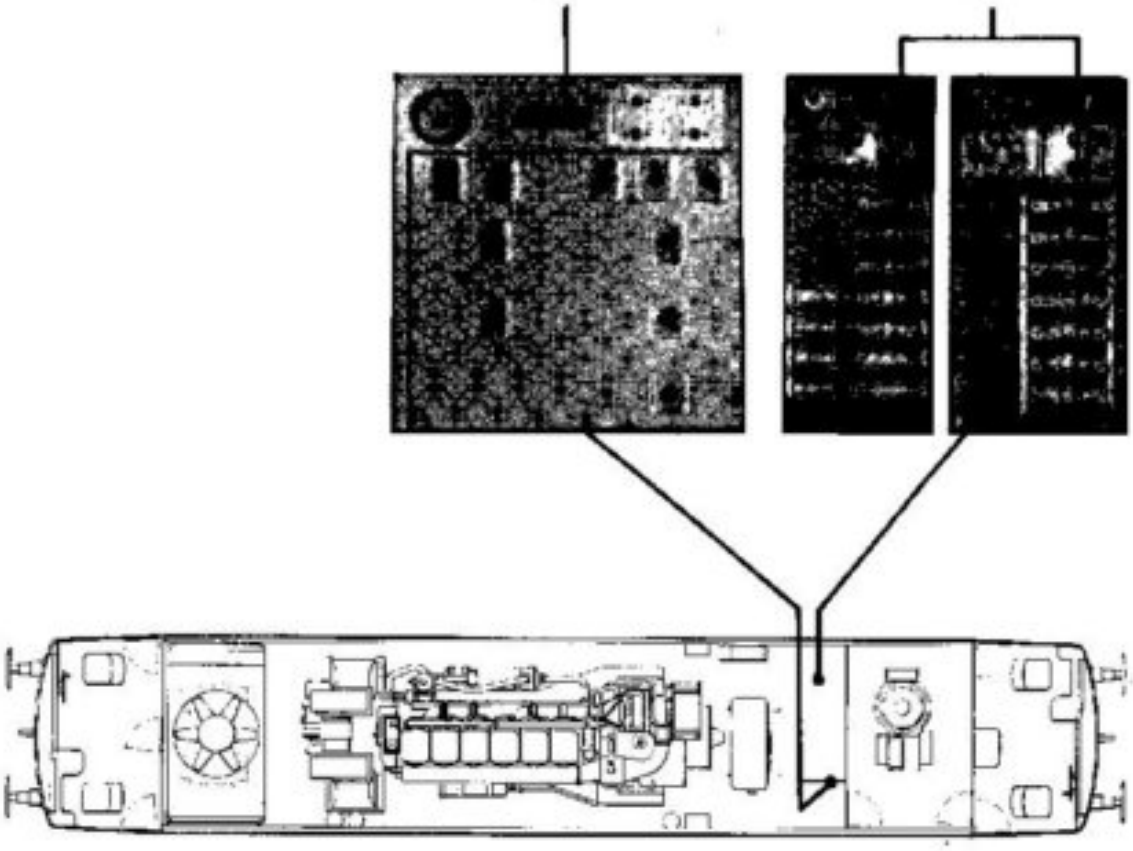
2. Check Battery isolating switch is 'On'.

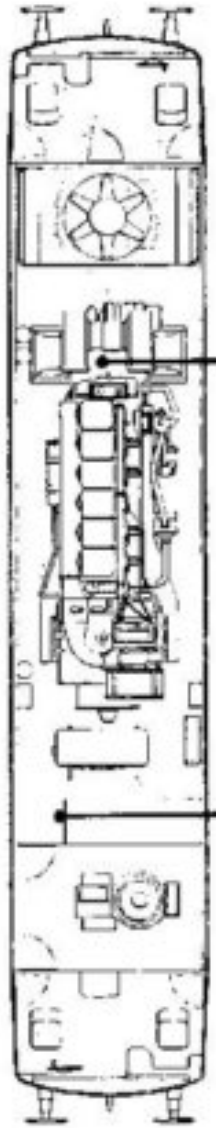


DESK ALARM LIGHTS DO NOT COME ON

3. **Check control circuit breaker switch is 'On'.**

4. **Check battery fuse (F1)** and renew if necessary. p.38

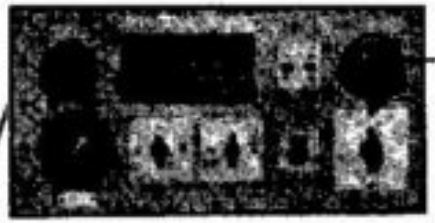




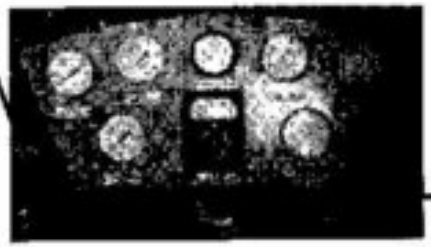
RED LIGHT BRIGHT

1. Engine does not motor.

1a. Check control air isolating cock is open.

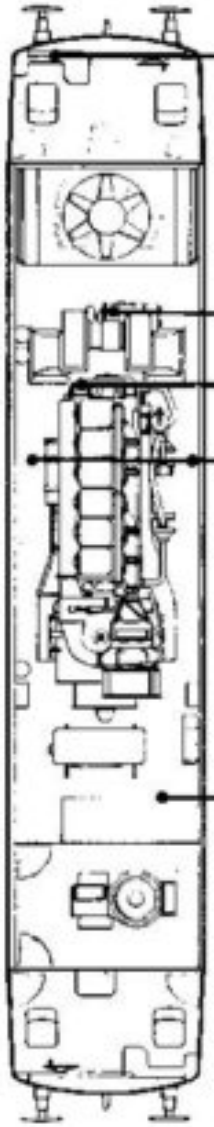


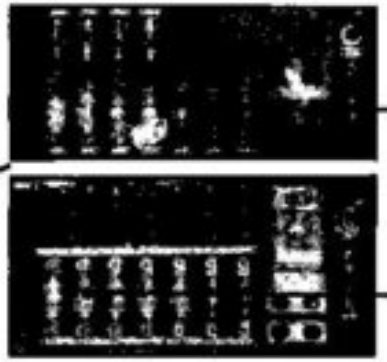
1b. Check equipment cut out switch is to 'Equipment'.



1c. Try start buttons in engine room and other cab.

If lights become very dim when start button is pressed, the battery charge may be too low for starting; request assistance.





RED LIGHT BRIGHT

2. Engine motors but does not fire.

2a. Press and release stop button.

2b. Press and release other cab stop button.

2c. Check overspeed trip, and reset if necessary. p.17

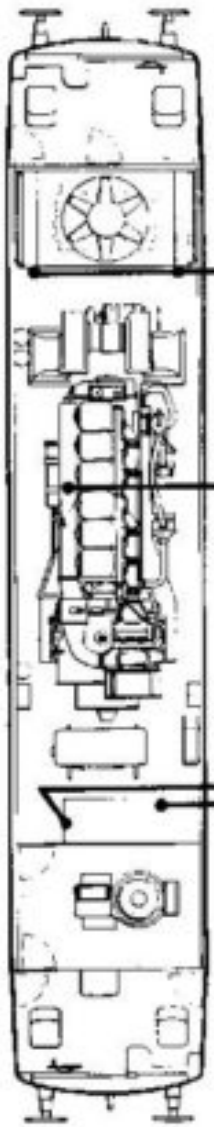
2d. Check pump set is running.

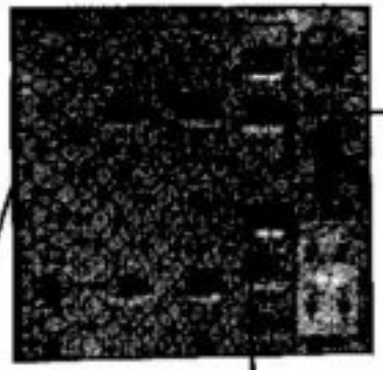
if not :—

2e. Check pump set fuse (F2) and renew if necessary. p.38

2f. Check main fuel tank gauge. 1.10, 1.27

2g. Vent fuel filters (follow procedure as under 'Engine Stops' check 5c).





RED LIGHT BRIGHT

3. Engine fires, but stops when start button is released.

3a. Check 'Water Failed' indicator.

if tripped relay is indicated :—

3b. Check sight level glasses on main tanks.

3c. Check 'Oil Failed' indicator.

if tripped relay is indicated :—

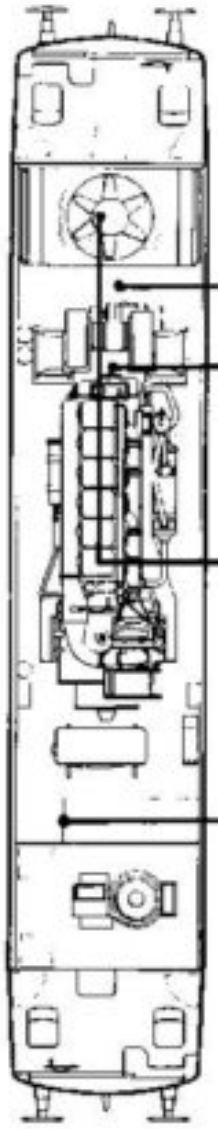
3d. Check oil level in engine sump with the dipstick and pump set running. p.24

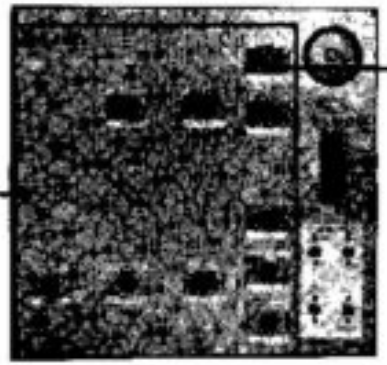
if not tripped :—

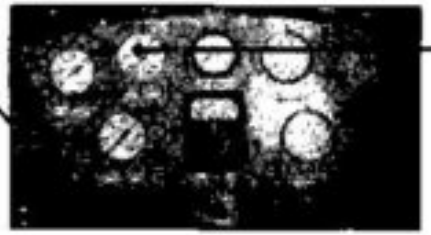
3e. Check auxiliary generator field fuse (F8) and renew if necessary. p.38

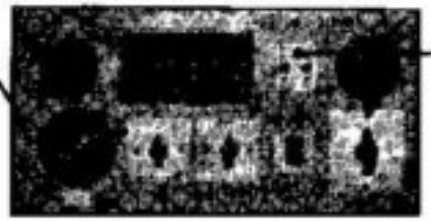
3f. Check auxiliary generator relay fuse (F9) and renew if necessary. p.38

3g. Attempt another start









NO LOSS OF POWER

1. **Reduce power and stop at first convenient place.**

2. **Check 'Water Hot' indicator.**

if tripped relay is indicated :—

2a. Check the coolant temperature.

if above 185 F :—

2b. Check coolant is passing through radiator by feeling upper pipes.

if these are not hot :—

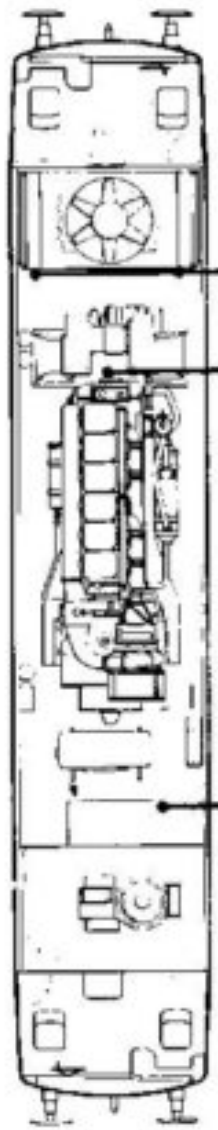
2c. Break seal on thermostatic by-pass valve (on 'Sulzer' type only) and move lever to 'direct'. f.18

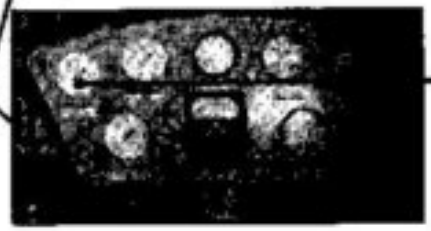
2d. Check radiator fan is running.

if not :—

2e. Move low speed fan switch to 'Hand' and 2 seconds after move high speed fan switch to 'Hand'.

if fan still does not run :—





NO LOSS OF POWER

2f. Check fuse F7 and renew if faulty. Return fan switches p.38 to 'Auto' before proceeding.

2g. Check coolant pressure is above 10 lb/sq.in.

if below :—

2h. Check for coolant leakage.

if none found :—

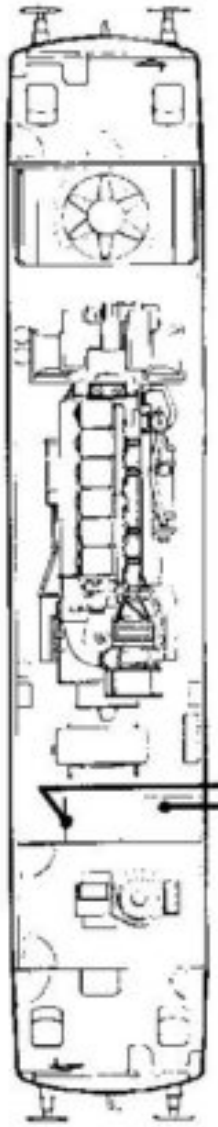
2i. Check sight level glasses on main tanks with pump set running.

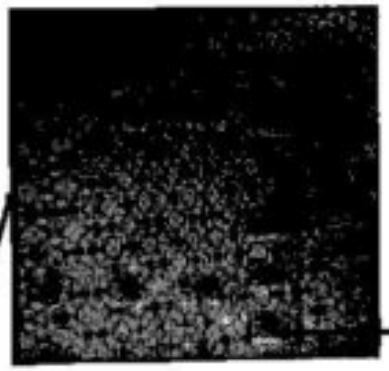
if level is low :—

2j. Fail the locomotive.

if no fault can be found :—

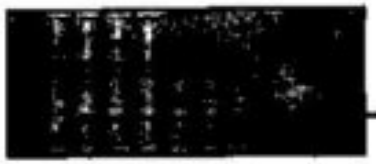
2k. Work forward at reduced power and fail locomotive at first convenient place. The locomotive must not be worked if coolant temperature exceeds 200°F.





3. Check 'Blower Stopped indicator.

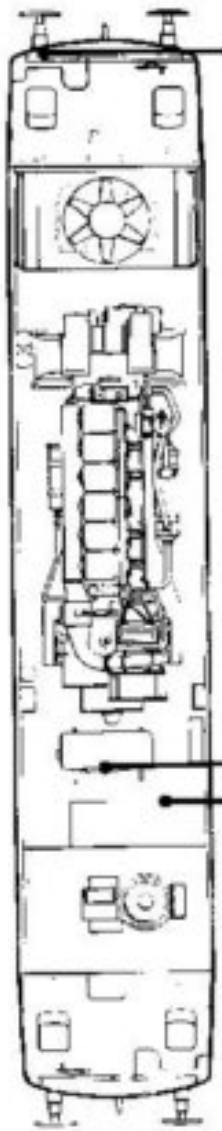
if tripped relay is indicated :—

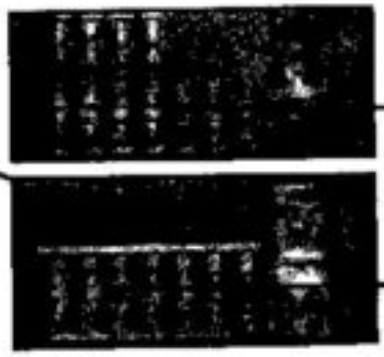


3a. Check fuse F6 and renew if faulty. p.38

if fuse not faulty, or replacement blows (blower cannot be restarted) :—

3b. Proceed for not more than 50 miles, limiting traction current to 900 amps for periods over 5 minutes.





NO POWER OR POWER IS LOST

1. **Bring train to a stand under protection of fixed signals if possible.**
Carry out any necessary Rules.

2. **Check main reservoir air pressure is above 60 lb/sq.in.**

if below :—

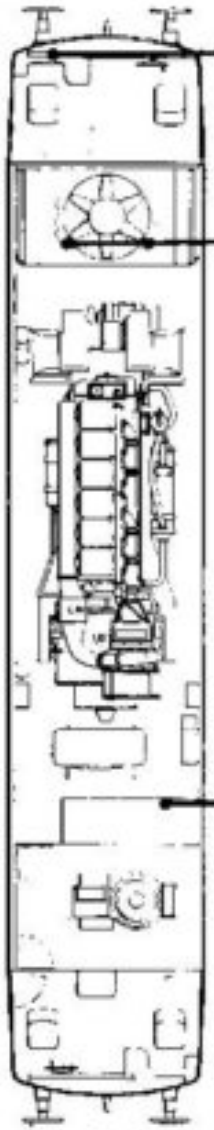
2a. Check air compressor is running.

if not :—

2b. Check fuse F3 and renew if faulty. p.38

if not faulty :—

2c. Blow down main reservoir, isolate the compressor governor and close drain cock again. Proceed normally with air blowing off at the safety valve.



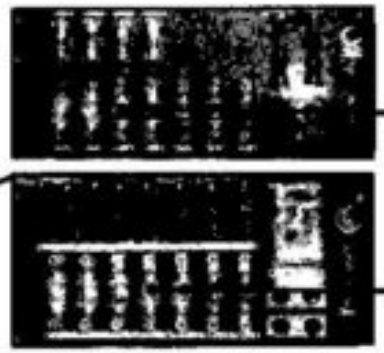
3. **Check train pipe vacuum gauge for loss of vacuum.**

if vacuum is not completely destroyed :—

3a. On a passenger train check whether a passenger communication has been made.

3b. Check whether one exhauster has stopped.

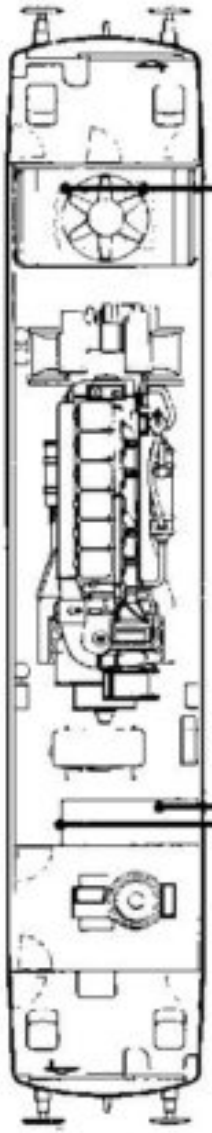
if so :—



3c. Check appropriate fuse (F4 or F5) and renew if faulty. p.38

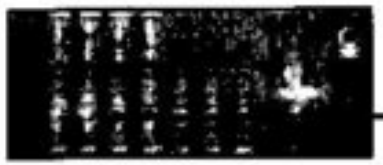
3d. Check for a vacuum break irregularity in accordance with BR standard procedure.

if vacuum is completely destroyed :—



NO POWER OR POWER IS LOST

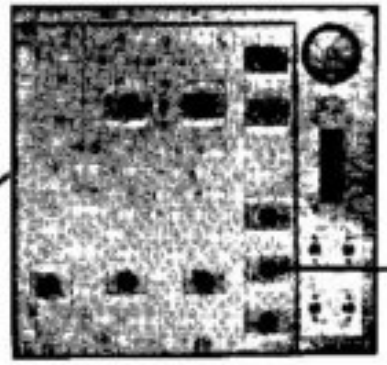
3e. Check whether exhausters are running.



if not:—

3f. Check fuses F4 and F5 and renew if faulty. p.38

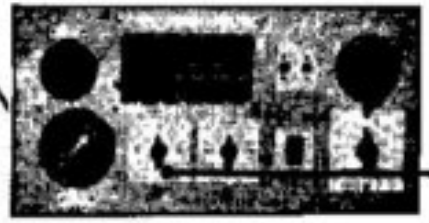
3g. Check drivers safety device in accordance with BR standard procedure.



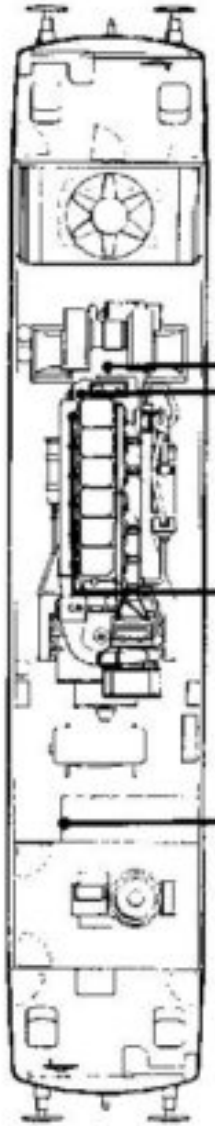
3h. Check whether guard has stopped the train (if fully braked), whether the train has divided (if partially or fully braked), or for a serious fault in the system.

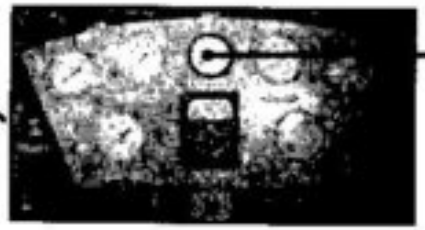
4. Check 'Earth Fault' indicator.

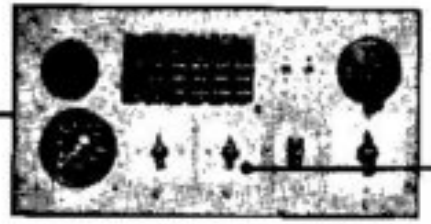
if tripped relay is indicated:—



4a. Open earth fault relay isolating switch and proceed normally. Fail locomotive on completion of journey.







RED LIGHT BRIGHT

1. **Stop train at most convenient place before vacuum is lost.** Carry out any necessary protection rules.

2. **Check engine overspeed trip and reset if necessary.** p.17 also checking that the fuel pump control shaft moves freely.

2a. Restart the engine and check its idling speed is 325-365 r.p.m.

if the overspeed trip again trips :—

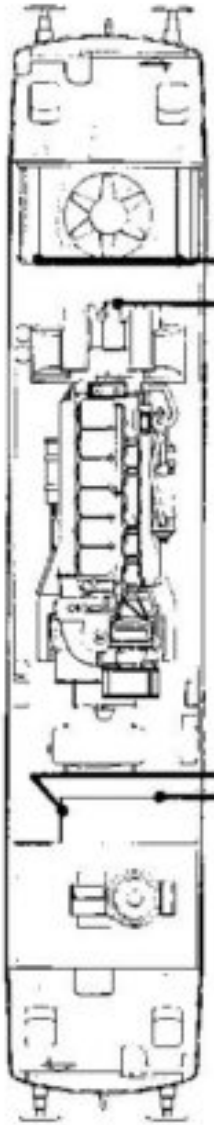
2b. Check each fuel pump in turn for a seized control rack.

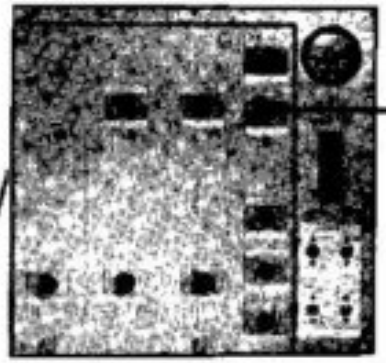
if one is found :—

2c. Isolate that pump, open the engine fault switch and restart the engine. Obtain a new locomotive at the first convenient place. p.20

if tripping persists :—

2d. Fail the locomotive.





RED LIGHT BRIGHT

3. **Check 'Water Failed' indicator.**

if tripped relay is indicated :—

3a. Check pump set is running.

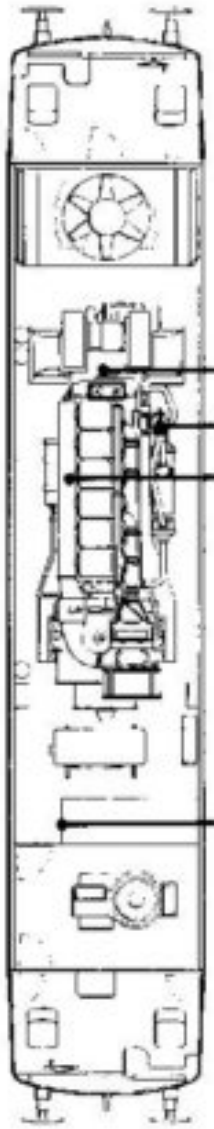
if not :—

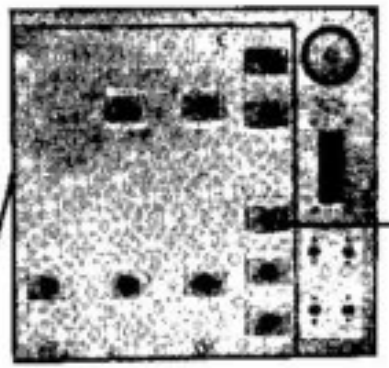
3b. Check fuse F2 and renew if faulty. p.38

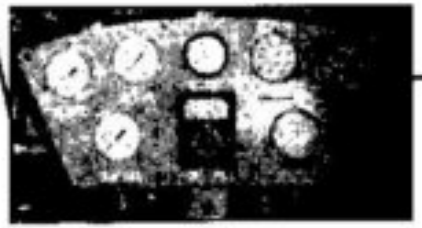
3c. Check sight level glasses on main tanks with pump set running.

if level is below minimum :—

3d. Check system for coolant leakage with pump set running and fail the locomotive.







4. Check 'Oil Failed' indicator.

if tripped relay is indicated :—

4a. Check oil level in engine sump with the dipstick and pump set running. p.24

if below 'Min' :—

4b. Fail the locomotive.

if above 'Min' :—

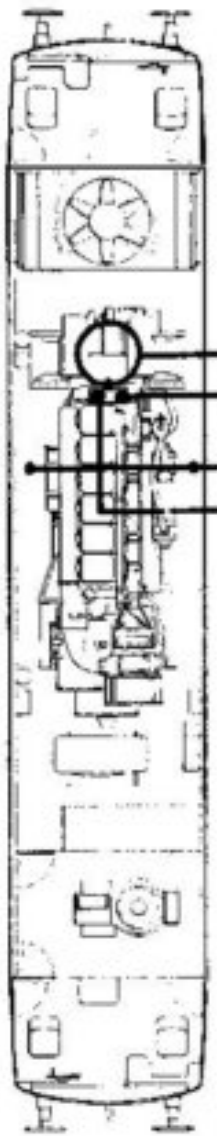
4c. Give the handle of the Knecht strainer six turns, and attempt to restart the engine.

if the engine will run :—

4d. Check the oil pressure is 20-25 lb/sq.in. at idling and if so proceed normally.

if the pressure is below 20 lb/sq.in. at idling or the engine will not run and no other cause can be found :—

4e. Fail the locomotive.



RED LIGHT BRIGHT

5. Check the main fuel tank gauge. 1.10, 1.27

if tank empty :—

5a. Close the pressure feed cock & steam generator fuel supply cock (when applicable) and open the gravity feed cock and fine filter by-pass cock with the key provided. p.21 p.18

5b. Re-start the engine and obtain a new locomotive within 10 miles or 15 minutes running.

if the tank is not empty :—

5c. With the pump set running open the vent screw on top of the fine filter and check whether fuel flows into the drip tray.

if fuel flows freely, the system is not defective.
if fuel does not flow :—

5d. Check the pressure feed cock and open it if closed.

if it is open and there is still no flow :—

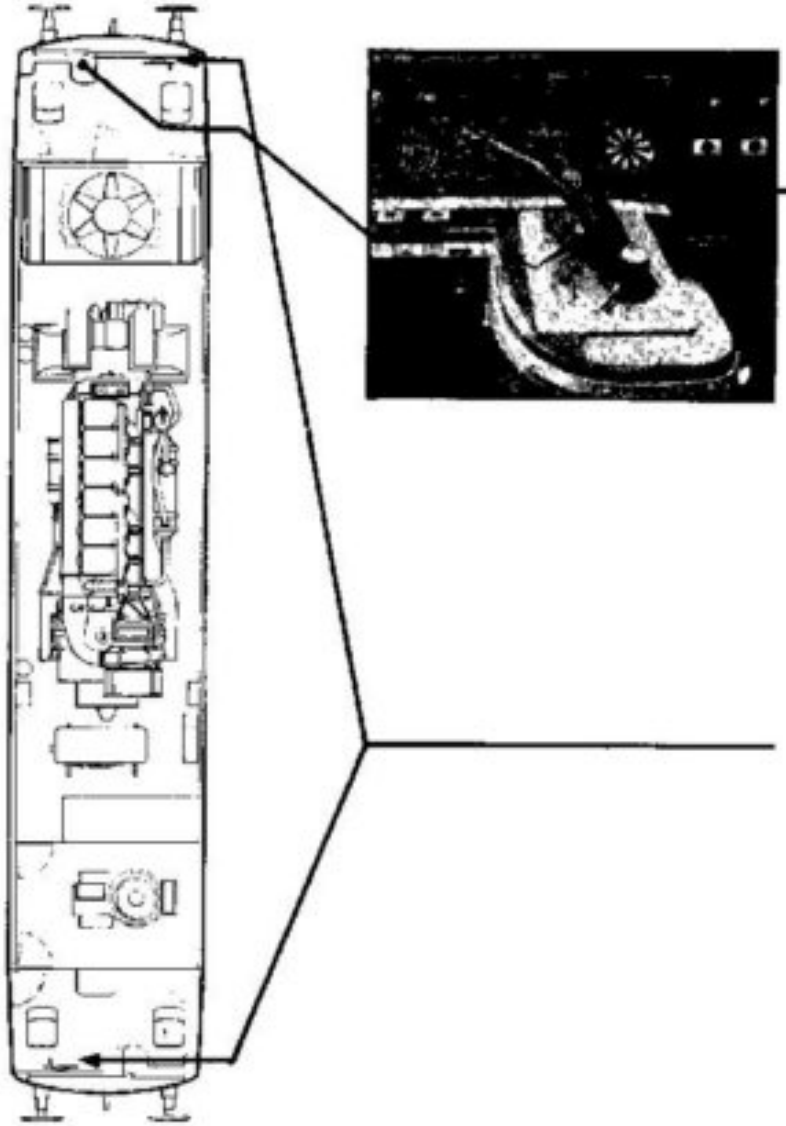
if no fuel flows :—

5e. Turn the fuel strainer handle.

5f. Open the fine filter by-pass cock with the key provided.

if fuel flows, proceed.
if no fuel flows the pump is defective :—

5g. Proceed as for an empty fuel tank (see 5a and 5b).



AT LOW SPEEDS INDICATES ONE OR MORE PAIRS OF WHEELS SLIPPING

if slipping persists :—

1. Ease power handle to a lower position.

if slipping still persists :—

1a. Move power handle to notch one and press the anti-slip button. Advance to required position and release button.

if rails are very greasy :—

1b. Apply sand before opening power handle.

AT SPEEDS ABOVE 30 M.P.H.

2. Check whether either handbrake is on.

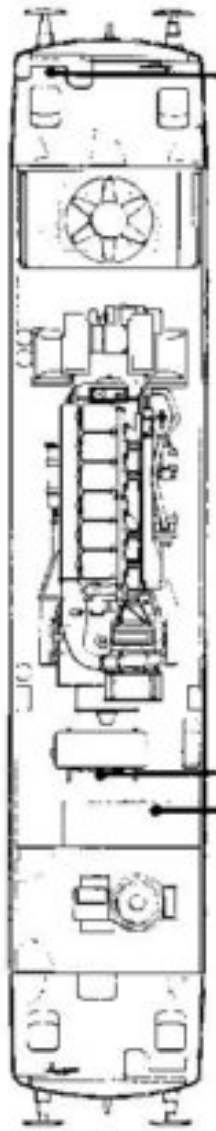
if occasional indications are given :—

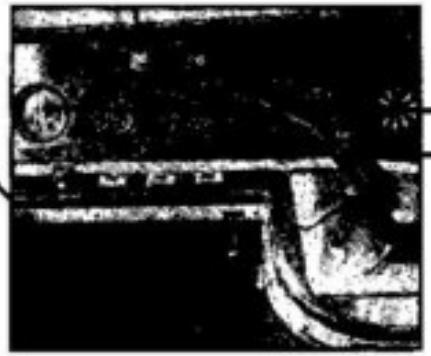
2b. Proceed, but report defect.

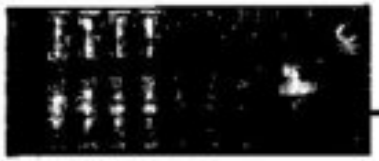
if frequent or continuous indications are given :—

2c. Limit power to below the level at which indications occur and fail locomotive at first convenient place.

NO POWER ON OPENING CONTROLLER







1. **Return power handle to 'Off', pause and apply power again more gradually.**

2. **Check main reservoir pressure.**

if below 70 lb/sq.in. :—

2a. Wait till pressure rises.

if pressure does not rise :—

2b. Check that compressor is running.

if it is not :—

2c. Check fuse F3 and renew if faulty. p.38

if not faulty :—

2d. Blow down main reservoir, isolate the compressor governor and close drain cock again. Proceed normally with air blowing off at the safety valve.

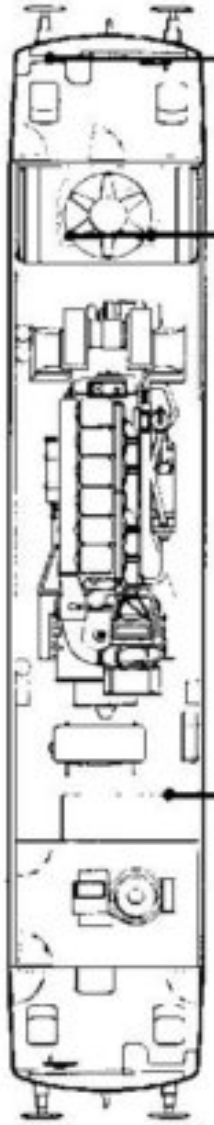
if compressor is running :—

2e. Check air reservoir drain cocks and close if found open.

2f. Check for leakage.

if no remedy possible :—

2g. Fail the locomotive.



3. Check vacuum gauge.

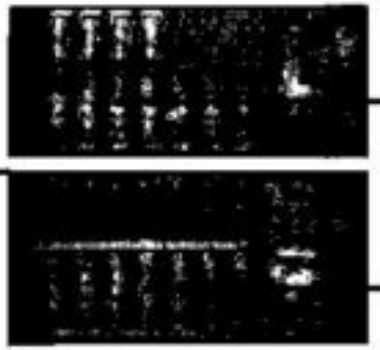
if below 15 in. :—

3a. Check rear cab brake valve handle and place in 'Running' position if it is not so.

3b. Check drivers safety device in accordance with B.R. standard procedure.

3c. Check exhausters are running.

if not :—



3d. Check fuses F4 and F5 and renew if faulty. p.38

3e. Check for external defects in train pipe.

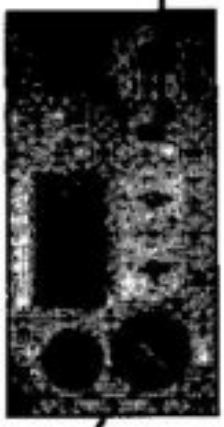
NO POWER ON OPENING CONTROLLER

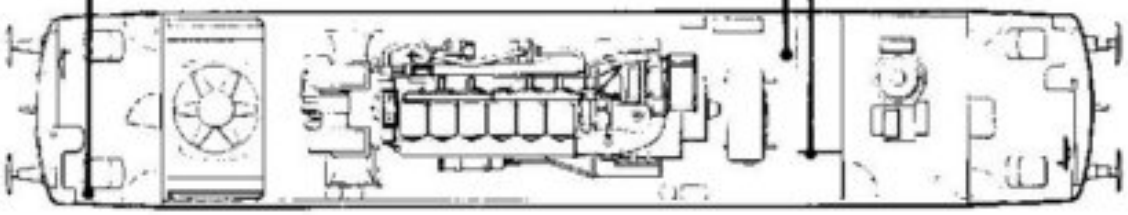
4. **Check that on the A.W.S switch unit in driving cab** (both blue & green painted) **the right hand handle is up and in the rear cab** (blue painted ones only) **the right hand handle is down**

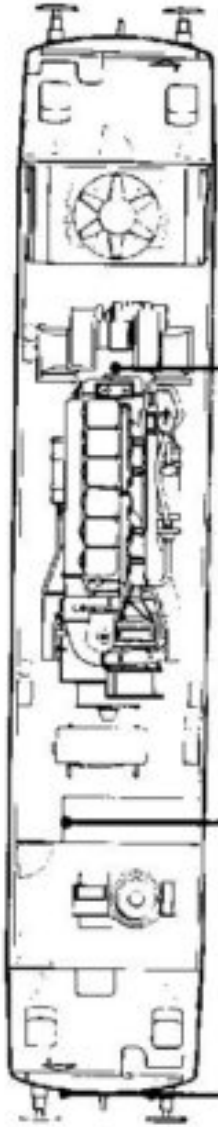
5. **Check whether field diversion circuits are defective by viewing indicator through round sight glass on control cubicle just above fuse panel door** (Not applicable to D.7598-7677).

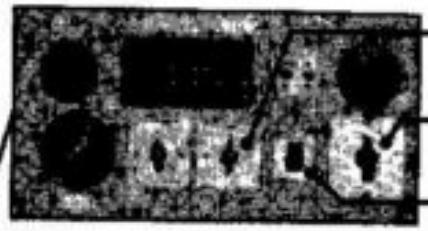
if the pointer is opposite any position other than 'Full':—

5a. Place the field divert switch to 'Off' and proceed with traction motors in full field. Obtain a fresh locomotive at first convenient place.









NO WARNING INDICATION

1. Check charging air pressure gauge.

if pressure seems low:—

1a. Check engine fault switch is to 'Normal'.

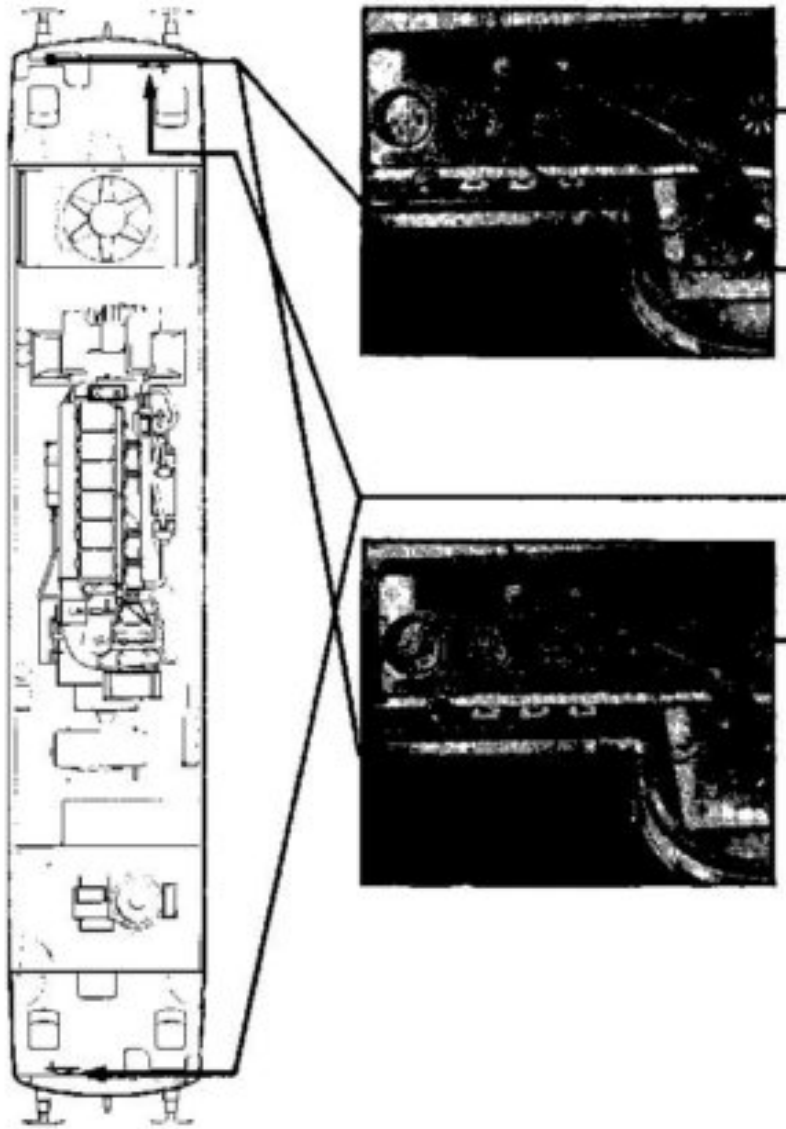
1b. Check motor cut out switch is to 'Motors All In'.

1c. Check field divert switch is to 'On'

Note: if any of the above are found switched to other positions, they must not be returned to the usual position without authority. Should power be sufficiently impaired as a result of this, assistance should be requested.

1d. Check for air lock in fuel system by venting fine filters (follow procedure as under 'Engine Stops', check 5c).

1e. Check buffer beam engine control pipe cocks are closed.



2. Check main ammeter reading.

if continually over 1300 amps :—

2a. Check brake cylinder pressure gauge.

if not at zero :—

2b. Check drivers' air brake valve.

2c. Check all locomotive handbrakes are 'Off'.

2d. Check full vacuum is being maintained.

if not :—

2e. Check locomotive and train for pipe defects.

if none found :—

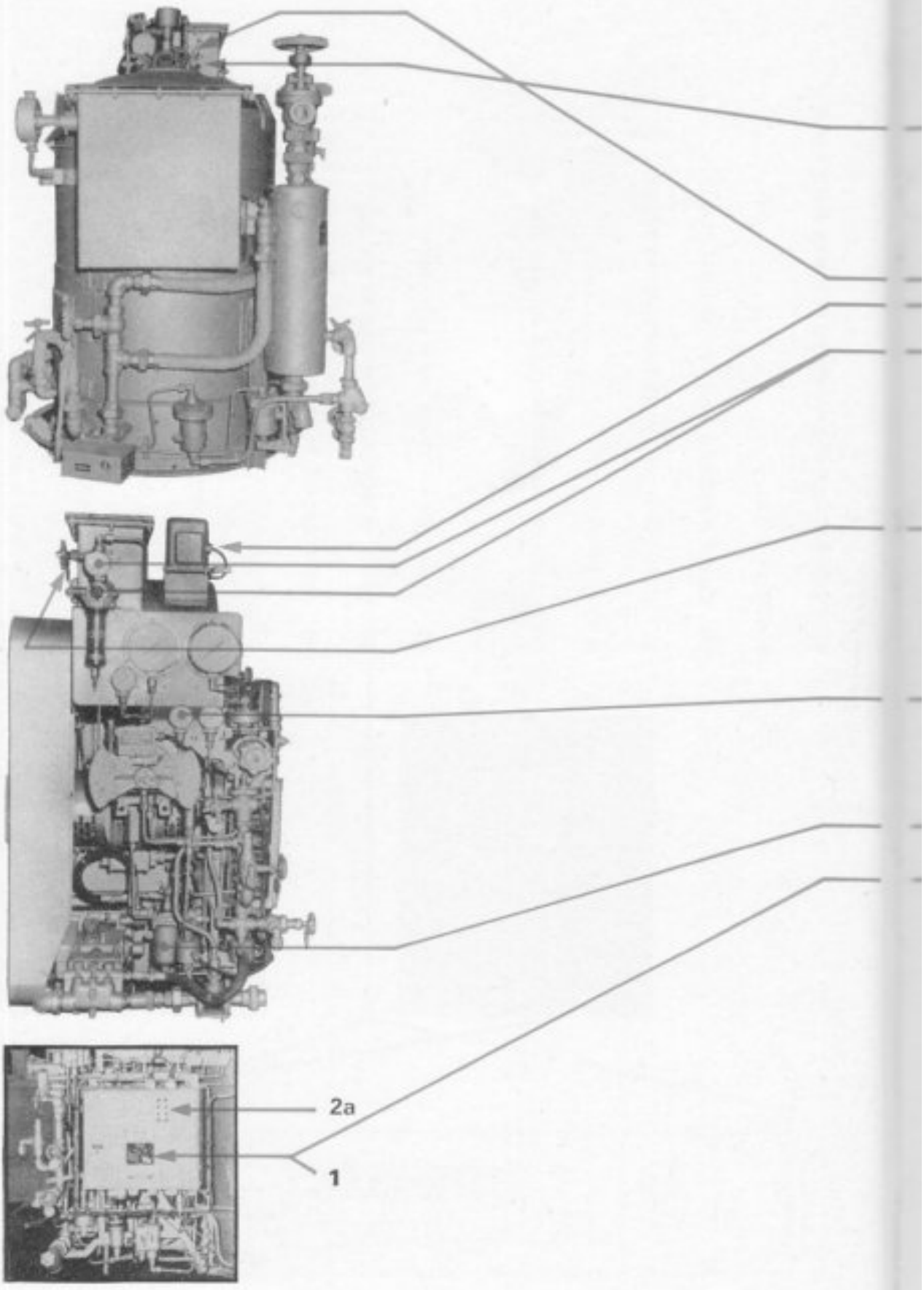
2f. Check train for passenger communication.

2g. Check whether a train hand brake is binding.

if nothing found :—

2h. Request assisting locomotive or reduce trailing load.

STEAM GENERATOR



MOTOR STARTS BUT BURNER DOES NOT LIGHT

1. Turn the control switch (102) to "Off".

2. Check for ignition failure through sight glass.

if no spark visible, or spark is of low intensity :—

2a. Check ignition fuses in control panel and replace if faulty.

2b. Check high tension cables to ignition electrode are connected satisfactorily and connections to transformer are secure.

3. Check atomising air pressure gauge (201) ensuring valve (33) is open.

if pressure is low :—

3a. Check main reservoir cock and air supply cock are both fully open.

3b. Check air admission valve (1) is fully open and that there is no restriction to the airflow in the line.

3c. Check position of the power handle, as, when at "Off" (e.g. when changing ends), the compressor will not run and lack of air pressure will cause first non-atomisation of fuel and then complete shut down. 27.3 28.3

4. Check fuel system pressure gauge (208).

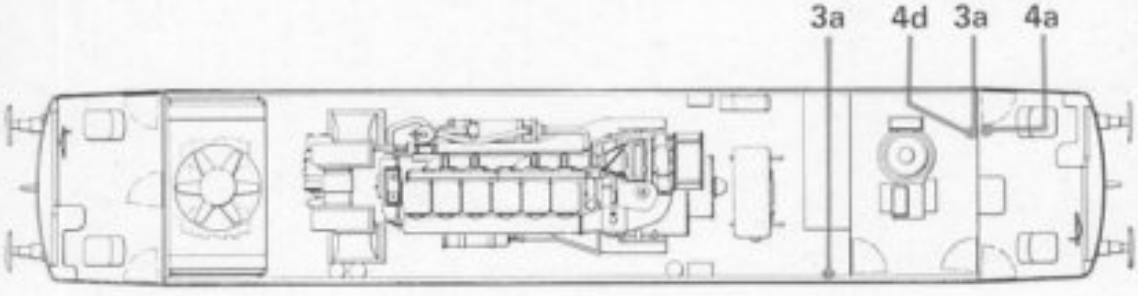
4a. Check main fuel supply cock (in engine room) and fuel isolating cock are open. 11.14

4b. Turn handle on suction line fuel filter (206) several times.

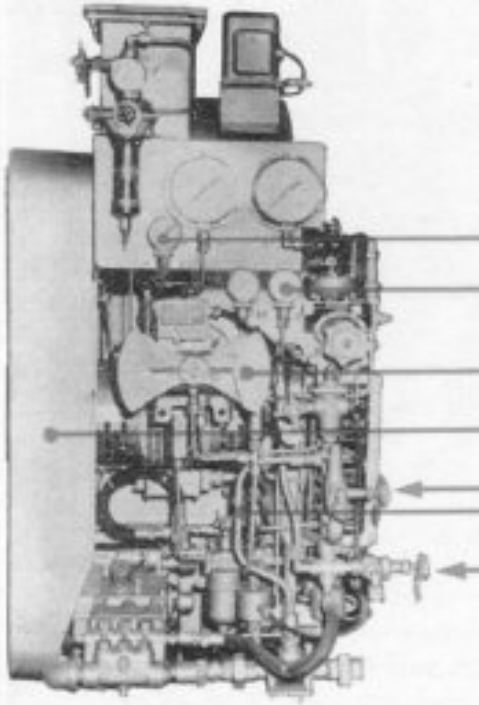
4c. Put control switch (102) to "Fill", to bleed the fuel line and bring the manifold pressure up to normal.

if the fuel system pressure is much above 150 lb/sq.in. :—

4d. Check valve (E) in return fuel line is open.



STEAM GENERATOR



—— **5. Check fuel nozzle pressure gauge (207).** (lack of water causes the servo fuel control to limit the fuel supply entering the nozzle).

if pressure is low :—

5a. Check feed valve adjacent to large filter (234) is fully open and cover on filter is tight.

—— **5b.** Check pump belts are correctly tensioned.

—— **5c.** Check water pump test valve (18) is closed.

—— **5d.** Check three way washout valve (17) is fully open.

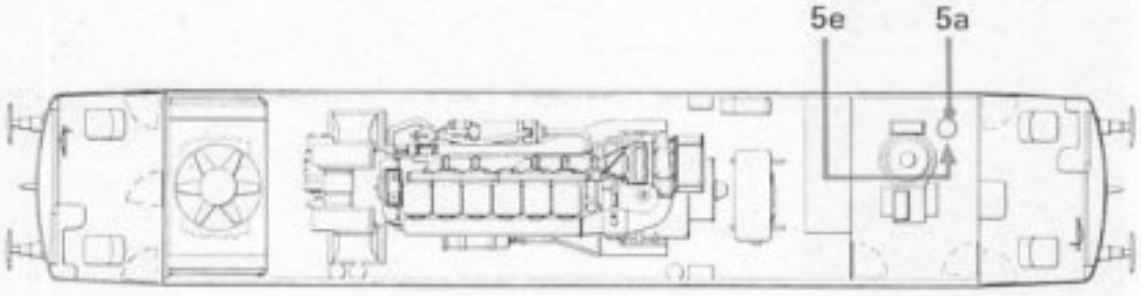
5e. Check drain cock (20) is tightly closed.

—— **5f.** Check manual water by-pass valve (8) is closed.

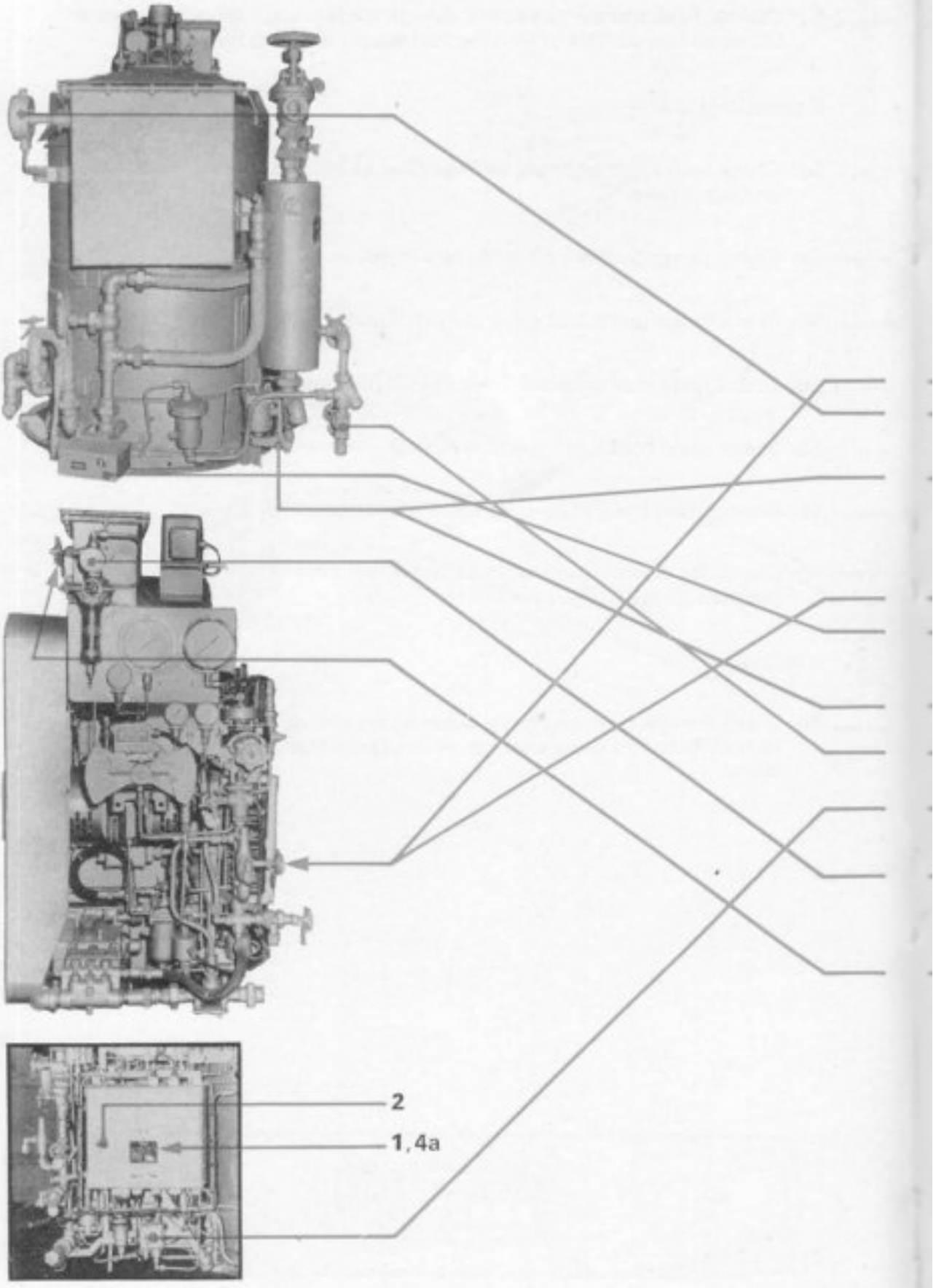
—— **5g.** Check for violent fluctuation of servo fuel control (108) or on water —— pressure gauge (229).

if found :—

—— **5h.** Bleed the line by opening the water pump test valve (18). Allow water to flow from this valve until no air or vapour bubbles are evident in the water.



STEAM GENERATOR



STEAM GENERATOR SHUTS DOWN DURING OPERATION — FAULT LIGHT BRIGHT

1. Turn the control switch (102) to "Off".

2. Check overload reset button (106).

if tripped :—

2a. Reset by pressing in button.

if it trips again :—

2b. Open manual water by-pass valve (8) slightly.

3. Check stack switch (109) reset button.

if it is out :—

3a. Open separator blowdown valve (12) and drain steam separator. Close valve and push in stack switch reset button. Then follow normal fill procedure.

if stack switch trips again :—

3b. Open manual water by-pass valve (8) slightly.

4. Check steam temperature limit control (110) reset button.

if tripped :—

4a. Reset by pressing in button and open separator blowdown valve (12). Turn control switch (102) to "Fill". When water is discharged from valve (12), open fill test valve (4). Close valve (12). When water flowing from valve (4) is cool, turn control switch (102) to "Off".

5. Check atomising pressure switch (101).

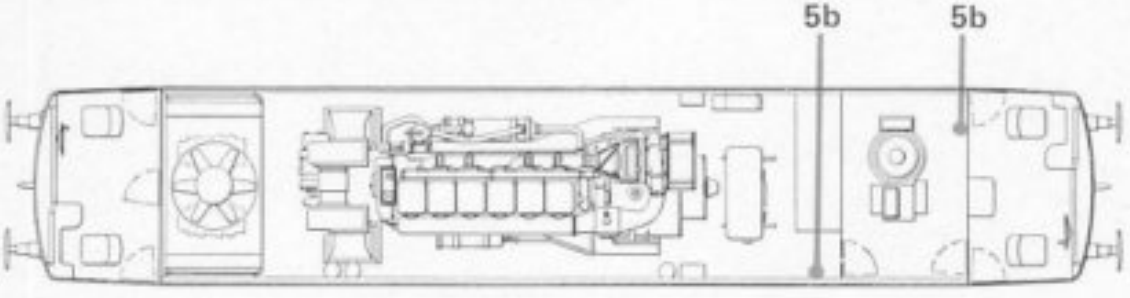
if contacts are open :—

5a. Check atomising air pressure gauge (201).

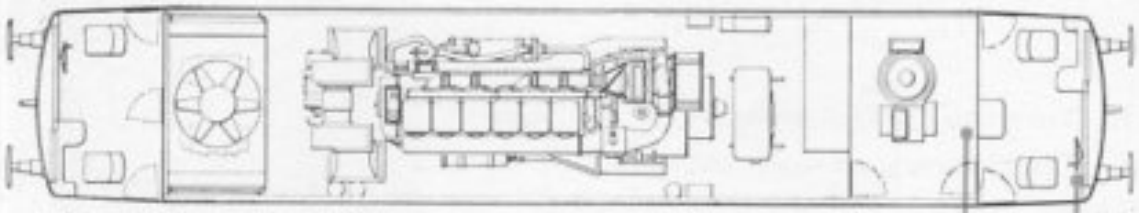
if pressure is low :—

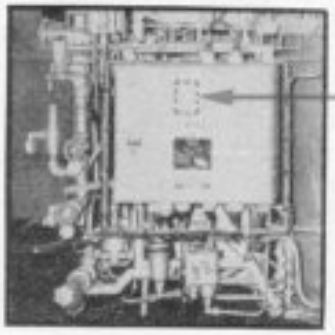
5b. Check main reservoir cock and air supply cock are both fully open.

5c. Check air admission valve (1) is fully open and that there is no restriction to the airflow in the line.



STEAM GENERATOR





STEAM GENERATOR FAULT LIGHT GOES OUT

1. Check for defective bulb and replace if faulty.

1a. Check fault light in other cab.

if both lights remain out :—

1b. Check steam generator switch is closed (i.e. handle up).

1c. Check control fuses in control panel and replace if faulty.